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ENERGY: STATUS AND DEVELOPMENT -- 37

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CHINA REPORT

ECONOMIC AFFAIRS

ENERGY: STATUS AND DEVELOPMENT -- 37

CONTENTS

HYDROPOWER

THERMAL POWER

COAL

OIL AND GAS

NATIONAL POLICY

NEW FUNDING SCHEMES PROPOSED FOR POWER INDUSTRY

OW100247 Beijing XINHUA in English 0229 GMT 10 Feb 85

[Text] Tianjin 10 Feb (XINHUA)--Central departments, local authorities, and businesses are now encouraged to raise money for power projects, according to the national economic conference here today.

Part of the electricity produced will be sold at market prices, which might be higher or lower than the government prices. The same principle applies to joint venture power projects using both Chinese and foreign capital or projects started with foreign investment, for the entire period of repayment for the foreign investment, capital plus interest.

Until recently, according to participants at the conference, it has been all up to the government to build sizable power projects, fix the price for electricity, and arrange the supplies.

They may raise money on their own or import foreign capital of set up joint ventures for expanding old power plants or building new ones or buy the right to use electricity.

The equipment and fuel needed may be provided by the state or imported from abroad, the conference said.

The fund-raising scheme has already started in Shanghai, Shandong and Anhui provinces on a trial basis.

According to the Ministry of Water Resources and Electric Power, it has signed 26 contracts with various provinces, municipalities, and autonomous regions for building power plants with a combined annual generating capacity of 8.65 million kiloatts in the next few years. More than half of the 7 billion yuan needed will come from localities.

According to the ministry's initial plan for the 1986-1990 period, a total generating capacity of 30 million kilowatts will be added, of which 25 million kilowatts will be financed by the ministry and the rest will come from localities and factories.

This, plus the new generating capacities of small hydroelectric power plants, will bring the nation's annual power generating capacity to 124 million kilowatts by the end of 1990.

CSO: 4010/84

NATIONAL POLICY

THE CURRENT SITUATION AND RATIONAL UTILIZATION OF ENERGY RESOURCES IN CHINA

Beijing DILI YANJIU [GEOGRAPHICAL RESEARCH] in Chinese Vol 3, No 4, Dec 84 pp 25-38

[Article by Fang Rukang [2455 1172 1660] of the Geology Department, East China Teacher's College]

[Text] Abstract

This article begins with a discussion of the concepts and categories of energy resources, describes China's energy resource reserves and their geographical distribution, then deals directly with the characteristics and problems of energy development and utilization, and provides some opinions on rational utilization of energy resources in China.

The Encyclopedia of Science and Technology defines energy resources as "those resources from which energy can be obtained in the form of heat, light or motive power."

Energy resources may be divided into two general categories on the basis of their mode of formation and utilization. One category is primary energy resources, which are natural energy resources that exist in a natural form in nature such as raw coal, crude oil, natural gas, and so on. The second category is secondary energy resources, which also are called artificial energy resources. These are primary energy resources that have been transformed through processing into other types and forms of energy resources such as coal gas, coke, gasoline and so on. In modern production and life, we often are unable to use primary energy resources directly because of technical and environmental protection requirements, the need to facilitate transmission and utilization, to improve labor productivity or other reasons. They must be processed into secondary energy products suited to the conditions of utilization. As science has developed and society has modernized, there has been a continual decline in primary energy resources as a proportion of overall energy resource consumption systems, while secondary energy resources have continued to increase in proportion.

Primary energy resources may be further divided into the two subcategories of renewable and nonrenewable energy resources depending on whether they are

"renewable" or not. Renewable resources include solar energy, hydropower, wind energy and so on. Nonrenewable resources include coal, petroleum, natural gas and such. The "energy crisis" that everyone is so concerned with today refers mainly to these nonrenewable primary energy resources.

Moreover, people have divided energy resources into fuel energy resources and nonfuel energy resources according to their nature. They also may be divided into conventional energy resources and new energy resources according to the conditions of their utilization. They also may be considered as clean and unclean energy resources. In order to explain the problem, I will attempt to provide a classification table for energy resources as shown in Table 1.

Table 1. Typology of Energy Resources

		Classified according to formational components	
Classified according to utilization conditions	Classified according to qualities	Primary (natural) energy resources	Secondary (artificial) energy resources
Conventional energy resources	Fuel energy resources	Non-renewable energy resources (chemical energy): Peat Lignite Bituminous coal Anthracite coal Stone coal Oil shale Oil sands Non-renewable energy resources (chemical and mechanical energy): Petroleum Natural gas Renewable energy resources (chemical energy): Biofuels	Chemical energy: Coal gas Coking coal Gasoline Kerosene Diesel fuel Heavy oil Liquified petroleum gas Propane Methanol Alcohol Alinine Waste energy
	Non-fuel energy resources	Renewable energy resources (mechanical energy): Hydropower	Electrical power: electricity Thermal energy: hot water Thermal and mechanical energy: steam Waste heat

[Table continued on following page]

New energy resources	Fuel energy resources	Non-renewable energy resources (nuclear power): Nuclear fuels	Chemical energy: Methane Argon
	Non-fuel energy resources	Renewable energy resources: Light energy: Solar energy Mechanical energy: Wind power Tidal energy Oceanic currents Wave motion energy Thermal energy: Seawater thermal energy Thermal-mechanical energy: Geothermal energy	Light energy: Lasers

Adapted from Xu Shoubo [1776 1108 3134], NENGYUAN JISHU JINGJIXUE [Energy Technical Economics], Hunan People's Press, 1981.

I. Energy Resource Reserves in China and Their Distribution

China has rich energy resources. We stand fourth worldwide in energy production and third in consumption. Primary energy output in China totaled 668 million tons (converted to standard coal) in 1982, a 5.7 percent increase over 1981, but it still cannot meet the need for development of the national economy as a whole.

China occupies first place worldwide in hydropower resources and second in solar energy resources (to the Soviet Union). We occupy third place in coal resources, surpassed only by the Soviet Union and America. We hold eighth place worldwide in petroleum resources. China also has rich natural gas, tidal, geothermal, wind and nuclear energy resources.

1. Coal

China has total coal reserves of 1.438 trillion tons and proven reserves of 770 billion tons.[1] Output reached 666 million tons in 1982, up 7.1 percent over 1981.[2]

The proven reserves are 17.5 percent anthracite, 37 percent coking coal and 45.5 percent bituminous, lignite and other types of coal. If annual extraction reaches about 1.2 billion tons by the end of this century and if we calculate according to the present 50 percent recovery rate, then proven and

extractable reserves would amount to 325 billion tons. Based on the annual output level of 1.2 billion tons, we could continue extraction for at least 260 years.[3]

China's coal resources are distributed extremely unevenly. The north region contains 71.13 percent, the northwest 9.05 percent, the east 8.65 percent, the southwest 5.16 percent, and the northeast 2.33 percent. The distribution of the proven reserves is 60.17 percent in the north, 11.3 percent in the southwest, 9.23 percent in the northwest, 8.73 percent in the northeast, 6.58 percent in the east, and 3.7 percent in the central south region.[4] Shanxi province contains more than 60 percent of the nation's total proven coal reserves and produces about one-third of total national output. It ships out 85 percent of the total amount of commodity coal nationwide, and is the national leader in product quality and product types.[5]

In addition, the south contains a large amount of stone coal, estimated at more than 100 billion tons. Hunan alone contains 27.3 billion tons with an ash content as high as 60 to 80 percent. It generally has a calorific capacity of 1,100 kilocalories/kilogram. It was not used as a coal resource in the past, but has now become a useful resource due to being used locally in the construction materials industry and in rural and small town enterprises. The ash content of coal gangue is as high as 70 to 80 percent and it usually has a calorific capacity of 1,500 to 1,800 kc/kg.[6] This coal gangue is dumped by coal washing plants after dressing and by mines during extraction. China now has 1 billion tons of coal gangue located mainly in the mining regions of the north and near coal washing plants, and dumps an additional 50 to 60 million tons each year. It is now being treated as a low thermal value fuel resource.

2. Petroleum and natural gas

China produced 102.12 million tons of crude oil in 1982, up by 0.9 percent over 1981. Natural gas output was 11.93 billion cubic meters. The newest data from petroleum industry departments shows an increase of over 500 million tons in new geological petroleum reserves in 1983, located mostly in the older oilfields at Daqing, Liaohe, Dagang, Huabei, Shengli, Zhongyuan and other areas in the east, and in areas near these oilfields.[7] Geological surveys show that China may contain as much as 4.5 million square kilometers or more of oil- and gas-bearing sedimentary rock, almost as much as the area of sedimentary rock in the United States (a little over 4.7 million square kilometers). There are over 300 sedimentary basins that can be explored for oil. And there are more than 1.2 million square kilometers of continental shelf along the coast that form an enormous geological foundation of petroleum resources for China. It has been estimated that China has 30 to 60 billion tons of petroleum resource reserves (our reserves have been estimated at 30 to 100 billion tons by foreigners).[8] China has only a few billion tons in proven geological reserves at the present time, so there is major potential.

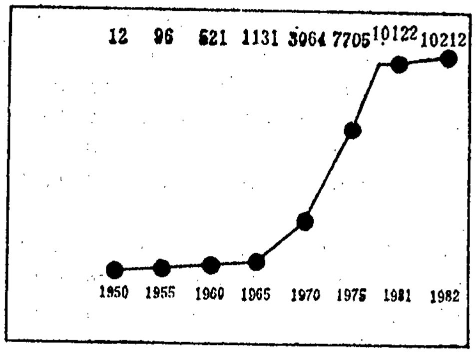

Figure 1. Growth in Petroleum Output in China, 1950-1982
(Unit: 10,000 tons)

Oil and gas pools and occurrences have been found from the ancient Sinian era to the newest Quarternary system. They are located in more than 20 of China's provinces, municipalities and autonomous regions. Only part of the reserves in shallow strata have been found in many of the regions with rich oil and gas resources. Examples include the Huabei [North China] Basin, with an estimated 8 billion tons and the Songliao Basin with an estimated 4.5 billion tons. The Qaidam Basin is felt to be an area where large oil pools may be found but there has been no good surveying or prospecting. Oil pools covering an area of 5,300 square kilometers with relatively rich reserves have been discovered in the Zhongyuan Oilfield at the juncture of Henan and Shandong Provinces.[9]

Six petroliferous basins have been discovered on the continental shelf along the coast of China, and some of them are linked to important oil pools on the continent. An example is the Bohai Gulf Basin, which is an extension of the Shengli, Dagang, Liaohe and other oil pools into the ocean. It covers an area of about 80,000 square kilometers and has already had one high-yield oil and gas well drilled. The East China Sea Basin covers an area of 460,000 square kilometers and several groups of oil- and gas-bearing structural zones. The first exploratory well yielded several oil sand strata and a high pressure oil and gas well. The petroleum exploration situation is even more pleasing in the South China Sea. The Pearl River Mouth [Zhujiangkou] Basin alone covers an area of 150,000 square kilometers. Geological departments drilled a series of seven exploratory wells there and measured two of them. Both showed industrial oil flows. China, therefore, has excellent prospects for oil and natural gas resources.

3. Hydropower resources

China has theoretical hydropower reserves of 680 million kW with an annual power output capacity of 590 [billion] kWh. Some 378 million kW has already been proven developable, with a total annual electricity output capacity of 190 billion kWh, the highest in the world (the Soviet Union has 269 million kW, Brazil has 209 million kW, the United States has 205 million kW, Canada has 153 million kW, and India has 70 million kW).[10]

Although China has abundant hydropower resources, the installed capacity is only 17 million kW at the present time and the growth rate is 4.5 percent. Hydroelectric power generation reached 74.4 billion kWh in 1982, up 13.5 percent from 1981[11] (the U.S. has an installed capacity of 70.65 million kW and a growth rate of 34.4 percent; India has an installed capacity of 9.75 million kW and a growth rate of 13.7 percent, both higher than China).

China's developable hydropower resources are distributed very unevenly, 67.9 percent being concentrated in the southwest. The central south contains 15.4 percent, the northwest contains 9.9 percent, the east contains 3.6 percent and the northeast contains 1.2 percent (Taiwan temporarily excluded).[12]

4. Biofuels

China has a forested area of 1.83 billion mu and timber reserves of 9.5 billion cubic meters. Annual firewood output is 198.2 billion jin. The thermal value in the forest resources has a calorific capacity equivalent to 3.9 billion tons of raw coal. There are 54 million mu of fuel forests with reserves of 44.71 million cubic meters. They produce 43.2 billion jin of firewood each year, equivalent to 120 million jin of standard coal, and are a primary resource in rural areas.[13] China now consumes an estimated 200 million cubic meters of forest resources each year, about 70 million cubic meters used as fuel.[14]

Crop stalks are the most important biofuel in the rural areas of China. China produces an estimated 458 million tons of stalks and 28 million tons of firewood each year. More than 6 million methane pits have been built in rural areas that produced about 700 million cubic meters of gas in 1981, and there are about 30 million people using methane. This is an important aspect of China's resource structure that cannot be ignored.

5. Solar energy

China receives the equivalent of 2 trillion tons of standard coal in solar energy each year. Two-thirds of the nation's area is in regions that receive solar radiated energy in excess of 140 kilocalories/cm^2.[15] The west has the most, with 1.4 to 2.0 million kilocalories/cm^2/year, while the east receives 0.8 to 1.6 million kilocalories/cm^2/year. The problem at the present time is cost.

6. Wind energy

China has an estimated 100 million kW in usable wind energy.[16] The conditions are best along the southeast coasts and islands, the Qinghai-Xizang Plateau, and parts of the north and northwest. The annual average wind speed in the northeast and along the eastern coast exceeds 3 meters/second, and there are 3 to 5 successive months where the wind speed approaches or exceeds 6 meters/second. The demand for electricity is fairly tense in these regions, and the islands must deal with the additional problem of fresh water. They should strive to develop wind energy resources as quickly as possible. The conditions are most favorable on Zhejiang's Shengsi Island, with a wind

speed of 7.2 m/sec, Dongshan Island off Fujian, with a wind speed of 7.3 m/sec, and Chengshantou in Shandong, with a wind speed of 7.8 m/sec.[17]

7. Oceanic energy

China is among the most richly endowed nations in the world in the area of oceanic energy. The development of oceanic energy resources is of special significance in the eastern and southeastern coastal areas that have coal shortages, dense populations and developed industries.

The theoretical estimate for China's coast is 1.7 trillion kW of wave motion energy, 50 million to 100 million kW of oceanic current energy, 150 million kW of seawater salinity differential energy and about 120 million kW of usable marine thermal energy, all of which can be used for generating electricity.[18]

8. Geothermal energy

Two of the globe's thermal belts pass through China. One is the Pacific Rim Thermal Belt and the other is the Mediterranean-Himalaya Thermal Belt. More than 2,500 hot water outcrops have been discovered in the 30 provinces, municipalities and autonomous regions of China [includes Taiwan].[19] Hot springs are concentrated mainly in the eastern coastal provinces, and in parts of Xizang, Yunnan and western Sichuan. There are 600 hot spring sites in the Pacific Rim Thermal Belt, about one-third all the hot spring points in China. The Xizang-Yunnan Thermal Belt is the region of the most intense hot water activity in China, and the first geyser field on the Chinese continent was discovered at Yangbajin near Lhasa in Xizang, with prospective reserves of about 150,000 kW.

9. Nuclear fuels

China has abundant nuclear energy resources including U^{235}, U^{238} and Th^{232} used in fission reactors and Deuterium, Li^{6} and other nuclear fuels used in fusion reactions. Preliminary proven reserves of natural uranium could provide enough fuel to operate nuclear power plants with a capacity of 15,000 MW for 30 years.[20]

10. Tidal energy

According to a survey done in 1981, China has tidal energy reserves of about 110 million kW and an annual electricity generation capacity of 275 [billion] kWh. About 38.5 million kW and 87 billion kWh are developable. This is roughly equivalent to 40 hydropower stations like the one at Xin'an Jiang.

In terms of overall reserves, China has fairly abundant energy resources. Per capita energy resource levels are fairly low, however, with total extractable reserves equal to only one-half the world average, one-tenth that in America, and one-seventh that in the Soviet Union.[21] There also are several unfavorable conditions related to the distribution and structure of energy resources, exploration and other areas in China. This is especially

true of the uneven distribution of energy resources. Coal is concentrated in the north, while more than half the petroleum is concentrated in the northeast. About 70 percent of hydropower resources are located in the southwest. The densely populated and industrially developed southeastern region, however, which has fairly high demands for energy resources, has a relative deficit of conventional energy resources. The long distance between energy resources and centers of energy consumption has inevitably engendered a great deal of long-distance transport of energy resources. Coal and petroleum shipments make up 43 percent of rail shipping and 47 percent of water shipping in China.[22] In order to meet the energy resource needs of modernization and construction, we certainly must do research on routes for rational and effective utilization of energy resources based on the current situation and special characteristics of energy resources in China.

II. Characteristics and Problems of Energy Resource Development and Utilization in China

1. The energy resource industry has developed rapidly.

Primary energy output in 1982 amounted to 668 million tons (converted to standard coal), up by 5.7 percent from 1981. The gross value of industrial and agricultural output in 1982 was 20.03 times the amount in 1949, while energy resource consumption was 26.29 times the amount in 1949, a 9.4 percent average annual rate of increase. Primary energy output in 1982 was equivalent to 28.8 times the amount in 1949 (see Table 2).[23] In just 14 years from 1967 to 1981, electricity output in China quadrupled from 77.3 billion kWh to 309.3 billion kWh. Total installed electricity generation capacity increased from 17 million kW in 1966 to 69 million kW in 1981, quadrupling in just 15 years. At the present time, all of the cities in China at the county level and higher, as well as 88 percent of the communes and 86 percent of the production brigades in rural areas are being supplied with electricity.[24]

China has not only achieved self-sufficiency in energy resources since the nation was founded, but has also continually expanded exports. The foreign exchange earned from exports of coal, crude oil and petroleum products amounted to about one-fourth of total national export foreign exchange earnings, being 22.5 percent in 1982. This shows that China's energy resource industry has developed rapidly.

2. Coal occupies a primary position in the energy resource structure.

Scientific and technical progress and industrial development has apparently eliminated the use of firewood, a first generation energy resource, in the industrially developed nations. Coal, the second generation energy resource, is now being gradually replaced with petroleum, the third generation energy resource. Coal retains its primacy in China's energy resource structure, and it will be hard to change this situation even over a long period of time.

Table 2. Growth in Energy Resource Production in China, 1949-1982

Year \ Item	Raw coal output (10,000 t)	Crude oil output (10,000 t)	Natural gas output (100 million m^3)	Hydropower output (100 million kWh)
1949	3243	72	0.07	7
1952	6649	44	0.08	13
1957	13073	146	0.70	48
1965	23180	1131	11.12	104
1970	35399	3065	28.7	205
1975	48224	7706	88.5	476
1980	60724	10591	138.5	567
1981	62278	10122	127.46	682
1982	66600	10212	119.3	774

Source: State Statistics Bureau, ZHONGGUO TONGJI NIANJIAN 1983 [CHINA STATISTICAL YEARBOOK 1983], China Statistics Press.

Shortly after Liberation, coal made up 96.3 percent of the energy structure in China, with only small amounts of petroleum and natural gas. Although petroleum as a proportion of the structure of energy production and consumption has increased to a substantial extent as the petroleum industry has developed, coal still makes up about 70 percent (Table 3). This characteristic should be considered when formulating energy resource production plans in China (Table 4).

Table 3. Changes in the Structure of Energy Resource Production in China, 1949-1982 (Figures in percent)

Year	Raw coal	Crude oil	Natural gas	Hydropower
1949	96.3	0.7	—	3.0
1957	94.9	2.1	0.1	2.9
1965	88.0	8.6	0.8	2.6
1978	70.3	23.7	2.9	3.1
1979	70.2	23.5	3.0	3.3
1980	69.4	23.8	3.0	3.8
1982	70.2	21.9	2.4	4.5

Source: State Statistics Bureau, ZHONGGUO TONGJI ZHAIYAO [CHINA STATISTICAL OUTLINE], China Statistics Press, June 1983.

Table 4. Comparison of Energy Resource Consumption Structures in China and Several Developed Nations, 1980

Item \ Country	China	U.S.	USSR	Japan	West Germany	France	England
Total energy resource consumption (million t std. coal)	603	2,714	1,588	565	387	271	284
Structure of consumption (percent)							
Petroleum	21.05	45.0	39.8	67.7	47.5	53.1	36.8
Natural gas	3.14	26.8	29.4	6.1	16.6	12.5	21.5
Coal	71.81	20.5	29.1	15.9	30.7	17.7	37.1
Hydropower and nuclear energy	4.00	7.7	1.7	10.3	5.2	16.7	4.6
Totals	100.00	100.0	100.0	100.0	100.0	100.0	100.0

Source: Wang Qingyi [3769 1987 0001], et al., "China's Energy Development Strategies and Policies," KEXUE [Science], No 12, 1982.

3. Industrial energy consumption is a major part of the structure of energy resource consumption.

The industrial sector accounted for a substantial part of the energy resource consumption structure in China, with more than 80 percent going to heavy industry. This characteristic is both a reflection of the lack of coordination in economic and industrial structures in China and a reflection of the failure to pay attention to energy use in the people's lives, especially energy consumption in rural life.

The industrial sector accounted for 69.4 percent of energy resource consumption in China in 1979, while 17.2 percent was consumed for commercial and civilian uses. Communications and transport accounted for 5.7 percent and agriculture consumed 4.9 percent, both figures quite low (Table 5). In 1980, the industrial sector in China still accounted for 67 percent of total energy consumption, while only 20 percent went for commercial and civilian uses. Communications and transport consumed only 4 percent and agriculture consumed 9 percent. The amount of commodity energy resources per capita in 1980 was only 610 kg of standard coal, only one-fourth the world average, one-eleventh the amount in the Soviet Union and one-twentieth the amount in America.[25] Urban residential electricity use (for residential lighting and household appliances) averaged only 12 kWh per person per year, a very low level.[26]

The proportion of energy resources consumed in the industrial sector in several developed nations is much lower than in China. The figure in 1978 for the U.S. was 36 percent. It was 37 percent in West Germany, 44 percent in France and 57 percent in Japan. The proportion used for communications and transport and for commercial and civilian uses in the primary industrial nations was much higher than in China, generally around 15 to 26 percent of total energy consumption, 1.5 to 3 times higher than in China. Commercial and civilian usage accounted for 20 to 26 percent of total energy resource

consumption.[27] This proportional relationship shows that the Western nations waste a great deal of energy resources in daily life and commerce, but it also shows the low level of household energy consumption levels in China. As the people's standard of living improves, the proportion of energy resources consumed in the industrial sector will gradually decline.

Table 5. Structure of Energy Resource Consumption in China in 1979

Sector	Energy Consumption (million tons of standard coal)	Proportion (percent)
Industrial sector	407.38	69.4
Communications and transportation	33.46	5.7
Agriculture	28.76	4.9
Commercial and civilian uses	100.96	17.2
Other	16.44	2.8
Totals	587.00	100.0

Source: Huang Zhijie [7806 1807 2638], NENGYUAN GUANLI [Energy Resource Management], Energy Press, 1982.

4. Biofuels predominate in rural areas, and they are causing environmental destruction.

Life in the vast rural areas of China still [depends on] the direct burning of biomass--a first-generation energy resource. These "primitive" energy resources have very low efficiency in utilization.

The rural areas of China consumed 320 million tons of standard coal for production and life in 1978, equal to 39 percent of total national energy resource consumption. Some 81 percent of the amount was used for living. Biomass fuels made up 84.1 percent of the energy resources consumed in rural areas (Table 6). In 1979, China used a total of 230 million tons of straw and stalks from primary grain crops such as rice, wheat and corn as fuel, 61 percent of the total amount of crop stalks and straw. This causes the country to lose 180 million tons of organic matter each year, as well as large amounts of nitrogen, phosphorus and other nutrients. The organic matter in the soil is not only not being replaced, but soil fertility is declining. We also have lost large amounts of livestock feed and industrial raw materials. Moreover, it has accelerated soil erosion and directly affected the development of agriculture, forestry, animal husbandry and sideline production.

Supplies of energy resources cannot meet demand in the rural areas of China, and the shortage of household fuels is particularly serious. According to a 1980 survey, 47.7 percent of all peasant households in China have serious shortages of firewood. Nationally, there are an average of about 3 months of shortages in household fuels. If we wish to solve this problem, we still

must rely primarily on all types of natural energy resources. This especially involves integrating with the characteristics of local areas, using multiple forms of energy resources, and striving to improve energy utilization efficiency.

Table 6. Structure of Energy Resource Consumption in the Rural Areas of China in 1978

Type of Energy	Amount of Material	Standard Coal Equivalents (million tons)	Proportion (percent)
Crop straw and firewood	540 million tons	270	84.1
Coal	36.36 million tons	25.97	8.0
Petroleum products	9.46 million tons	13.51	4.2
Electricity	27.5 billion kWh	11.96	3.7
Totals	--	321.44	100.0

Source: Huang Zhijie [7806 1807 2638], NENGYUAN GUANLI [Energy Resource Management], Energy Press, 1982.

5. High energy consumption, serious waste.

China ranks third in the world in total energy resource consumption, but our energy waste during consumption is more severe and our utilization efficiency is far lower than in the developed nations because of our backward technologies, poor management and other reasons.

The value of industrial output created per ton of standard coal in Japan in 1980 was $2,548. The value was $1,108 in America, $1,064 in the Soviet Union, $2,334 in West Germany, and even India exceeded $1,000. The figure for China was only a little over $470, however, half the amount in America, the Soviet Union and India, and one-fourth to one-fifth the amount in West Germany and Japan.[28]

Calculating according to the amount of standard fuel consumed to create a unit of GNP, with total energy resource consumption in 1980 of 600 million tons and a GNP of $285.5 billion, an average of 211,100 tons of standard fuel were consumed to create each $100 million of GNP. Energy consumption per unit of GNP in China is 3.8 times greater than in Japan, 3.3 times greater than in West Germany, 1.8 times greater than in England, and double the amount in America.[29] The labor productivity of each worker in the main coal-producing nations of the world is as high as about 10 tons, but has remained between 0.8 and 0.9 tons in China.[30]

Foreign countries are now playing close attention to effective utilization of energy resources. The utilization efficiency of energy resources in Japan has reached about 57 percent in recent years. The figure is about 51 percent in America and about 40 percent in West Germany and other countries, but is only 30 percent in China. According to statistics comparing the amount of

energy consumed per unit of product in China with advanced levels abroad, thermoelectric power is 1.8 times as much, steel is 1.9 times as much, cement is 1.72 times as much, and refined petroleum is 1.52 times as much.[31] China consumed 1.4 tons of standard coal per ton of steel in 1981, but the figure in Japan was only 0.681 tons. China consumes 435 grams of standard coal to produce a single kWh of electricity, while Japan uses 334 grams. China consumes 2.7 tons of standard coal to produce a ton of synthetic ammonia, while Japan uses 1.2 tons.[32]

Moreover, China washes only a small amount of coal. The amount dressed in 1981 was 117 million tons, only 18.8 percent of the total. All of the raw coal sold abroad by many nations is dressed, however. This situation increases shipping and energy consumption. Moreover, we are unable to meet the demand for particular types of coal in different industries, which has caused serious waste. The level of crude oil processing also is fairly low in China, and many components that could be used as raw material in the chemical industry are now being extracted or separated, and more rationally utilized. We can see that there is major potential for energy conservation in China.

III. The Prospects for Energy Resources in China

There is a fundamental difference between China's current energy resource shortage and the energy crisis of the capitalist world. However, if we do not immediately formulate a scientific energy resource plan and adopt effective measures, the problem of energy resource shortages will persist and affect the rate of development of the national economy.

If we wish to achieve the strategic goals of modernization and construction within 20 years and double total output, then we must improve the utilization rate of energy resources and use the same amount of energy resources to create double the value of output compared to now, so that 1 ton of energy resources are used as 2 tons.[33]

The strategic goals for developing energy resources in China by the year 2000 are: to strive to meet the demand for energy resources coming from economic growth and gradual improvements in living standards and to form a system where there is "coordinated development of all types of energy resources, more rational distribution, higher productivity and utilization rates, and improvements in energy use and the environment in urban life"; to achieve a preliminary solution to the problem of rural energy resources and basically put an end to the degradation of the ecological environment caused by the serious nationwide shortage of energy for household use in rural areas. We should summarize experiences, lessons, analysis, and prospects for the future, and we should pay attention to the following points in energy resource development and utilization in China:

1. Carry out technical reforms, conserve energy resources.

In 1980, China formulated an "energy policy of combining energy development and conservation, and giving primacy to energy conservation in the short run."[34] On the basis of overall strengthening of scientific management of

energy resources, we should shift the core of energy conservation toward technical transformation.

China has a large population. The basic problem is that energy resource supplies cannot meet demand and that per capita energy consumption levels are very low. There is, however, fairly serious waste of energy resources and very low utilization rates, so there is great potential. This is mutually related to our low economic, technical and educational levels.

The basic need in energy conservation is to adopt all technically feasible, economically rational, socially acceptable and environmentally permissible measures to raise the utilization rate of energy resources. China has achieved some results in conservation and reduced usage of energy resources. In 1980 and 1981, despite being years of 1.3 percent and 1.6 percent declines in energy production respectively, the gross value of industrial and agricultural output grew by 7.2 percent and 4.5 percent.[35] The demand for energy resources was met primarily through conservation in energy resource consumption, most of it becoming available through relying on reorganization of economic structures, strengthening management and pressuring for a reduction in energy resource consumption. It should be noted, however, that the future for such energy conservation is very limited. For this reason, energy conservation in the future must depend mainly on technical transformation and equipment replacement.

According to statistics, China now has 200,000 boilers (not including power plants) that consume about 200 million tons of coal annually at an average operational efficiency of 55 percent. If we can raise this figure to 65 percent, we can save 36 million tons of coal annually. If the amount of energy consumed in making a ton of steel in China's iron and steel mills could attain the level of the Hangzhou Steel Mill, we could conserve more than 7 million tons of coal annually. If we go further and achieve the level of Japan, we could conserve 20 to 25 million tons of coal annually. A 1-percent increase in the ash content of coal raises coal consumption by 2 percent. If the dressing capacity for coking coal and power coal could be raised to 80 percent (the current figure in China is 70 percent, and is 90 percent in Japan and France), we could save 50 million tons of coal each year. Major waste exists throughout extraction, shipping, refining and self-utilization in China's petroleum system. It is estimated that more than 2 million tons of oil equivalent to more than 5 million tons of standard coal could be conserved each year if we reach the levels of advanced foreign countries.[36]

Energy conservation concerns everyone in their daily life. The civilian [cooking] stoves now in use, especially the wood stoves used in rural areas, have extremely low thermal efficiency, about 10 to 15 percent. The wood-conserving stoves that are manufactured all over have a thermal efficiency of 20 to 30 percent, which could cut fuel consumption by half. If we popularize this sort of stove across the country, we could conserve wood having a thermal value equal to more than 9 million tons of standard coal. It is estimated that consumption of crop straw and stalks could be cut by one-third if 50 million peasant families begin using wood-conserving stoves in

the next 10 or 20 years.[37] If this straw is used as fertilizer on farmland, it would be equivalent to applying more than 13 billion jin of fertilizer. This would increase grain output by more than 20 billion jin and would also improve the agricultural ecological environment.

2. Establish a comprehensive energy resource system, utilize all usable energy resources.

While China has been debating the importance of certain energy resources in recent years, we often have had a tendency toward failing to place appropriate emphasis on a particular energy resource or we have underestimated its role as an energy resource. This is not favorable to correct evaluation, rational development and effective utilization of China's energy resources. Energy resource development should be done in accordance with local conditions, make use of advantages, and utilize all usable energy resources to carry out comprehensive development.

Looking at the future prospects for energy resources in China, although there are relatively abundant amounts of various energy resources in absolute terms, there are major differences in their geographical distribution and development conditions. This means that we cannot simply rely on a particular energy resource to solve the enormous energy supply problems in a particular area. China's energy resources are distributed unevenly. The eastern and northeastern regions, which have greater demand, have fewer hydropower resources and less coal. Over the years, this has caused us to continue shipping coal from north to south and from west to east, and transmitting electricity from west to east. This has affected shipping and economic results. If, however, we establish a comprehensive energy resource system based on the distribution, types and other conditions of the energy resources in each area, there could be a major improvement in the supply and demand situation.

The eastern China region, for example, accounts for 32 percent of national income but has only 6.8 percent of the nation's guaranteed coal reserves and 16 percent of the petroleum. The effective utilization rate of energy resources in the east is the best in the country: the national income from a ton of standard coal (931 yuan) is 57.8 percent higher than the national average (470 yuan) [as published]. In terms of per capita amounts of energy resources on hand (124.2 tons of standard coal), however, the eastern region is in last place nationwide at only 17.9 percent of the national average.[38] This means that the eastern region must ship in nearly 20 million tons of standard coal each year. The region does, however, have a certain amount of developable and usable energy resources of various types that could be used to create a new situation if they are rationally organized and mutually supplementary in spatial terms.

The eastern region had prospective coal reserves of 104.977 billion tons and guaranteed reserves of 44.3 billion tons. Current development levels, however, are only 43.6 percent in Shandong, 26.4 percent in Anhui, 72 percent in Jiangsu, 73 percent in Jiangxi and 73 percent in Fujian. Shandong and Anhui Provinces are, therefore, base areas for coal energy resources with

rich potential. The hydropower resources in the rivers of the eastern region contain theoretical reserves of 30 million kW, 44 percent of which is located in Zhejiang, Fujian, and Jiangxi. The annual average amount of power generated is 260 billion kWh, so the current development rate is only 22 or 23 percent. Complete development of these hydropower resources would be equivalent to more than 27.5 million tons of standard coal or more than 15 million tons of crude oil. The region also is the region of the greatest concentration of tidal energy resources with a developable installed capacity of 19 million kW and annual electricity output of 50 billion kWh. A large-scale tidal energy power station with an installed capacity of 4.7 million kW could be built at the mouth of the Qiantang Jiang alone. Moreover, the region also has some uranium, bitumen, oil shale, peat and other energy resources. Technologies for utilization of methane and solar energy developed first here in China. The eastern region has insufficient supplies of any single energy resource. In terms of the regional organization of all types of energy resources, however, many problems could be solved through development in stages, fostering mutual supplementation of many types of energy and rational distributions.

3. Reorganize energy resource allocations, ship out secondary energy resources.

The geographical distribution of the primary energy resources in China is extremely uneven. This requires construction of land and water shipping on a large scale. The total investments for transportation construction to ship coal from west to east and from north to south equal or exceed the total investments in coal mine construction. This is an enormous problem that cannot be ignored.

One measure of strategic importance that concerns the overall situation in rational development and utilization of the energy resources in China is to reorganize new allocations of the energy resource industry in Shanxi Province, to develop the electric power industry, heavy industries, chemical industries and so on that consume large amounts of coal locally, and to ship to other provinces secondary energy resources such as electric power, coal, gas, methanol, as well as other coal and chemical industry products.

Preliminary plans show that the installed electricity generation capacity in Shanxi Province will reach 20 million kW by the end of the century, and that the annual gross value of output in heavy and chemical industries that use coal as a primary raw material will exceed 5 billion yuan.[39] These figures are 7 and 5 times greater, respectively, than in 1982. Electric power departments in Shanxi Province have estimated that coal consumption for power generation in the province will increase from 7.66 million tons in 1982 to 16 million tons in 1985. The amount of electricity transmitted to the Beijing-Tianjin-Tangshan Grid will grow from the current level of 700 million kWh to 9 billion kWh by 1985. Heavy and chemical industries that use coal as a raw material also will be developing in Shanxi during this time. A total of 1.6 billion yuan was invested in the Lucheng Chemical Fertilizer Plant. A full set of equipment for producing synthetic ammonia, nitrogenous and phosphorous fertilizers and other products was imported

from West Germany. The amount of coal used in the coal chemical industry in Shanxi Province could exceed 3 million tons by the end of the Sixth Five-Year Plan, almost double the current amount. This would not only reduce coal shipping, but could also greatly conserve on energy resource consumption.

4. Integrate hydropower and thermal power, give priority to developing hydropower energy resources.

The rate of growth in energy resource consumption has consistently exceeded (or led) the growth rate of the national economy. An important long-term strategic principle for energy resource construction in China is to give priority to development of hydropower energy resources and gradually increase the proportion of hydropower resources.

Hydropower resources are renewable conventional energy resources. They are lost forever if they are not utilized. Only 4.8 percent of China's abundant hydropower resources have been developed up to the present time, so there is substantial potential.

China also has extremely rich small-scale hydropower resources, about 70 million kW being developable. Only 8 million kW or 11 percent of the total have been developed at the present time. More than 1,100 of the nation's 2,000-plus counties have small-scale hydropower resources over 10,000 kW.[40] Small-scale hydropower resources can play a role in developing rural electricity use and increasing county and township incomes. This is especially true in frontier and minority nationality regions where power grids have not been extended, so small-scale hydropower construction is even more urgent. One kilowatt-hour of electricity is equivalent to 4 or 5 jin of firewood. This makes "substituting electricity for firewood" in regions with hydropower resources especially important for protecting forest resources and ecological conditions.

5. Speed up development of new energy resources.

New energy resources and renewable energy resources are the fundamental energy resource system for the future of the world. Energy use now is in a tense situation not only in China's cities at the present time, but is even more serious in the form of a fuel shortage for peasants and herdsmen. It will be hard to solve the energy utilization problems of frontier regions and of peasants and herdsmen if we merely rely on conventional energy resources. Using natural energy resources like major development of hydropower, solar energy, wind energy, geothermal energy, methane and so on is definitely feasible.

Nuclear energy is a new energy resource that is technically mature now. It can be utilized on a large scale to supplement shortages of fossil energy resources. Nuclear energy is now considered a conventional energy resource in foreign countries. China has the conditions for developing a nuclear power industry, but nuclear power is still in the preliminary stages at the present time. The initial investments for nuclear power stations are higher than for coal-fired power stations, but fuel expenses are lower after

construction is completed. The costs of nuclear power are lower than for coal-based power in regions distant from coal mines.

Solar energy is inexhaustible natural energy, but it is now only being utilized in a small-scale and scattered manner. When compared with nuclear power, solar power is strongly decentralized, of low intensity, intermittent and difficult to use, while nuclear power is highly decentralized and provides high-intensity energy and is suited to continuous operation. The popularization of solar-powered water heaters and other equipment in the cities of China could reduce the environmental pollution caused by burning coal. Solar cookers could play an obvious role in supplying peasants with energy for household use in rural areas that have good solar radiation conditions and fuel shortages. On the other hand, using solar energy for large-scale electricity generation must await breakthroughs in science and technology.

There also are some renewable energy resources subject to regional restrictions such as wind energy, tidal energy, geothermal energy. China began studying electricity generation with wind power in the 1950's, and the wind-powered generator manufacturing industry has developed rapidly. The generators are of high quality and expensive. The Jiangxia Tidal Power Plant in Zhejiang Province has an installed generator capacity of 3,000 kW, and is second in the world only to the Rance Tidal Power Station in France. Most of China's geothermal resources are located in southern Xizang, western Yunnan and along the eastern coast, and can be used locally.

China has excellent energy resource conditions and a considerable industrial foundation and technical strength. The most urgent tasks now are to determine a long-term development strategy, formulate scientific energy resource policies and plans, and adopt decisive and effective measures so that we can establish a strong energy resource industry system during this century and provide abundant energy resources for the four modernizations.

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NATIONAL POLICY

THE DEVELOPMENT OF ENERGY RESOURCES FOR CIVILIAN USE EXPLORED

Beijing ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] in Chinese Vol 4, No 5, 21 Oct 84 pp 34-37

[Article by Lu Changmiao [7120 2490 8693] of the Ministry of Construction Environmental Protection Bureau and Fu Lixun [0265 4539 8113] of the State Science Commission New Technologies Bureau: "Exploring Directions for Developing Civilian Energy Resources in China"]

[Text] The primary civilian energy resources in China at the present time are loose coal, molded coal (with or without a desulfurization agent), petroleum liquefied gas, natural gas, petroleum gas, methane, coal gas, electricity and others. We feel that, among these types of energy resources, civilian electric cooking utensils have good environmental, energy conservation and economic results.

1. Electricity is the cleanest energy source, and popularization of civilian electrical cooking appliances in areas with the proper conditions is an effective measure for attaining atmosphere quality goals.

Atmospheric pollution from coal has become extremely severed in China's cities in recent years, especially during the winter heating season in the north. It appears most prominently as dust, sulfur dioxide and carbon monoxide in pollution from coal smoke. The civilian cooking utensils that pollute the most have a thermal efficiency of only 10 to 20 percent. The countless small coal stoves cause a large amount of pollution from dust, sulfur dioxide and carbon monoxide at ground level and in the lower atmosphere. A secondary source of carbon monoxide pollution also comes from petroleum liquified gas and coal gas use for heating and cooking.

In recent years, the adoption of low sulfur, low ash coal for urban supplies, the addition of desulfurization agents to molded coal, the utilization of various types of energy conserving boilers and dust removers, the adoption of combined heat and electricity production, central heating and other measures have permitted some control over the danger from sulfur dioxide and dust. Little attention has been paid to carbon monoxide pollution, however. In 1982, in order to formulate environmental quality standards for atmospheric carbon monoxide concentrations, several monitoring stations, medical colleges, hospitals and epidemic prevention stations in Beijing

Municipality and Shenyang City made simultaneous measurements of carbon and oxygen levels in the hemoglobin of about 7,000 different people and of indoor and outdoor atmospheric carbon monoxide concentrations in several model regions using different energy sources. The results are shown in Table 1.

Table 1. The Relationship Between Indoor and Outdoor Carbon Monoxide Concentrations and Different Types of Energy Sources

Energy source used for heating and cooking	Small coal stoves used for cooking and heat (molded coal)	Small boilers for heating, petroleum liquified gas for cooking	Central heating, cooking with coal gas	Clean regions	State Standards for carbon monoxide
Indoors:					
Average range of carbon monoxide concentrations (mg/m)	2-19, 11-15 (model value = 28.4)	2.2-18.7 8.86	0.6-18.6 3.7	1.37	The maximum permissible concentration in industrial enterprise design public health standards is 1 mg/m^3
Exceeds public health standards (%)	100	96.8	50		
Outdoors:					
CO concentration (mg/m)	6-9	3.9-4.5	3.3	0.73	The maximum daily average values for atmospheric environmental quality standards are: Level 2: 4 mg/m^3 Level 3: 6 mg/m^3
Exceeds environmental standards?	Exceeds Level 3 standards	Exceeds Levels 1 and 2 Standards	Does not exceed standards	Does not exceed standards	

Note:

The indoor data was too low because of:
1. Non-ideal environment
2. Measurements taken in bedroom instead of kitchen

It can be seen from the observed values in Table 1 that during the winter heating season in the north, indoor levels of carbon monoxide in the air were 1 to 2 times greater than outdoors. Families using small coal stoves (mostly pot-bellied stoves) for cooking and heating had indoor carbon monoxide concentrations of 2 to 19 mg/m^3, and the model value for 3 hours would be 28.4 mg/m^3. In this environment, 20 percent of the people would have hemoglobin carbon and oxygen contents in excess of 4 percent, which is extremely dangerous. Moreover, the hemoglobin carbon and oxygen content would exceed 2 percent for 81 percent of the people. This is higher than the level of human tolerance. It can be seen from Table 1 that burning petroleum liquified gas and coal gas also creates carbon monoxide pollution indoors in residences to different degrees. It was discovered as early as 1970 by Siderenko that the carbon monoxide concentration after burning household coal gas for two and one-half hours in a room with poor ventilation would reach 32.3 mg/m^3, while even with excellent ventilation in the room, the concentration would reach 13.4 mg/m^3, many times greater than the standards. For this reason, we feel that coal is an energy resource that causes serious pollution, that liquified petroleum gas is a polluting source of energy, and that coal gas is an energy source of light pollution. Using electricity discharges no carbon monoxide or other pollutants, so it is a clean and non-polluting energy resource.

2. Electricity will become the energy resource used for civilian cooking that has the maximum energy conservation results.

Although using electricity as an energy source for civilian cooking involves two transfers of energy from heat to electricity to heat and has a low thermal efficiency, there is some hope that the power generation efficiency of power plants can be improved through adoption of advanced modern science and technology. Table 2 compares the overall thermal efficiency of each type of energy resource.

Table 2. A Rough Comparison of the Overall Thermal Efficiency of Various Energy Sources

Energy Source	Thermal Efficiency (percent)		
	Thermal efficiency of power generation or coal gas*	Utilized thermal efficiency (%)	Overall thermal efficiency
Electricity:			
Integrated heat and electricity power plants	43.8		26.4 - 33.9
Power plants with large ultrahigh voltage generators	38.4		23.1 - 30
Current domestic high thermal efficiency power plants	36.6	70 - 90	21.9 - 28.2
Current domestic low thermal efficiency power plants	29		17.4 - 22.4
Coal gas:			
Luji pressure coal gassification plant	55 - 60		18 - 30
Molded coal:			
Small coal stove	28	30 - 50	8.4 - 14
Loose coal:			
Small coal stove	10 - 18		5.4 - 9

*Does not include the 4 to 7 percent of the electricity used in the plant itself or 7 percent losses in the power grid.

It can be seen from Table 2 that overall thermal efficiency in China's power plants is lower than that of coal gas at the present time. However, if we adopt large scale high efficiency power generation equipment (large ultrahigh voltage generator sets with critical or supercritical parameters can reduce coal consumption from 413 to less than 330 g/kWh, or there can be integrated heat and electricity production near cities by "changing condensing power stations into thermal power stations," which could reduce average coal consumption for power generation to a predicted 280 to 330 g/kWh or so by the year 12,000 [as published]). This could raise thermal efficiency during power generation in China's power plants from the current level of 29 percent to 36.6 percent, and even to 38.4 percent in the future, and would reach the advanced level of 38.4 to 43.8 percent with integrated heat and power production. The use of ultrahigh voltage power transmission, hydroelectric power and peak regulation over large areas could reach grid losses and

redundant capacity. Adoption of energy-conserving cooking utensils could raise thermal efficiency even higher. For this reason, we predict that electricity will provide energy conservation results equal to or better than coal gas.

Petroleum liquified gas is one of the main sources of energy for cooking in the urban areas of our country. Petroleum liquified gas has better thermal efficiency and economic results when used for civilian purposes than when used as an industrial fuel. Because petroleum liquified gas also is a raw material for chemical refining, however, it will have an economic value 10 to 100 times greater than when used as a civilian fuel if it is instead turned into plastic, rubber, fiber and other synthetic materials. Moreover, it cannot be considered a clean source of energy and has many hidden dangers to safety. We should develop in the direction of chemical refining and gradual reduction of liquified gas supplies for civilian use.

3. Electricity as an energy source for civilian cooking is feasible in the future and has fairly good economic results.

Electricity supplies in China are inadequate at the present time, and the investments in capital construction for electrical cooking are higher than for coal gas. There is, therefore, no way that using electricity for civilian cooking can become widespread. When China begins utilizing the advanced technologies of the Shanxi energy base area and other large scale pit-mouth power plants and the large scale hydropower stations on the Chang Jiang, Huang He and other river systems, however, the electrical power shortage basically will be solved. If power transmission lines use ultrahigh voltage and form computer automated optimum peak regulation grids, the peak regulation distance could be extended beyond 1,000 km. In Beijing, for example, power loads can be regulated to the south as far as Wuhan through interconnection with the Shanxia and Gezhouba power junctions, and to Shenyang in the north through interconnection with the northeast power grid. National peak regulation can be achieved after all of seven large regional power grids are interconnected. At that time, daily schedules between cities can be changed to stagger peak power usage between cities. Rational arrangements for industrial electrical use can allocate peak differentials between civilian and industrial power use. Using hydropower for peak regulation can save on construction of hydropower stations and also give play to the superiority of peak regulation through hydropower. Moreover, the civilian power load in China is low, equal only to about 4 percent of the total load, so the small peaks would be easy to regulate. Generally speaking, the time when electricity is used for cooking occurs at low peaks for industrial electricity use. In order to improve efficiency in power plants, we should do as the industrially-developed countries have done and encourage [urban] residents to use electricity by setting up preferential pricing policies for electricity for civilian use. Moreover, regulation of peak loads for civilian electricity usage could greatly reduce the installed capacity needed for electricity for civilian cooking and naturally would lower overall investments in capital construction. We may calculate the investment per kW of capacity in hydropower at about 1,400 yuan (thermal power is generally lower than hydropower, but it is hard to estimate because of power grid

regulation fees). In a preliminary estimate, if every household has an electrical load of less than 1 kW, then the investment in capital construction will be close to or less than the investment for coal gas (if we figure that each household uses 2 m^3/day of coal gas, then the investment per household for coal gas [capital construction] would be 1,300 to 1,500 yuan). Moreover, this would eliminate the need for building large gas storage tanks and the auxiliary coal gas pipelines, and can cut down on the long-distance shipping of coal and ash and conserve on pollution controls in coal gas plants and other expenses. If we calculate costs and effective thermal value (electricity costs: thermal power = 0.03 yuan/kWh; hydropower < 0.02 yuan/kWh; coal gas = 0.10 yuan/m^3), the operating costs will be less than for coal gas. The comparative economic and energy conservation results of electrification and coal gassification are point of contention among scholars at home and abroad. During our comparisons and calculations, we discovered that assuming different conditions provided totally different results. One point that can be confirmed, however, is a prediction that in the future, the economic results of using electricity for civilian cooking will be equal to or higher than coal gas. Development of electrical power for civilian cooking will become feasible as the national economy develops and the people's standard of living rises.

4. Using electricity for civilian cooking is the developmental direction in all nations of the world.

Energy sources for civilian cooking in both London and Moscow have gone through the three stages of loose coal → molded coal → coal gas → electricity. Electricity used for heating and civilian uses in the residential areas of West Berlin is supplied by an interconnected grid of six power plants located around the near suburbs. These cities all have abundant coal gas energy resources but have gone over to electricity for civilian cooking. This is a basic measure for guaranteeing indoor environmental quality.

5. Several problems must be solved to develop electricity use for civilian cooking:

1) Transform the backward situation of serious shortages in electricity supplies, large numbers of small industrial generators that consume large amounts of energy, outdated technical equipment and poor energy conservation and economic results. During the process of developing the electrical power industry to solve our country's electricity shortage, we should adopt advanced technologies to reduce coal consumption for power generation from 413 to about 330 grams per kWh. We must strive to build as many coal and electricity base areas as fast as possible and adopt large ultrahigh voltage, sub-critical or even supercritical generator sets. We should actively develop thermal power plants near cities and improve the proportion of thermal power so that the ratio is no less than 10 percent. We should strengthen the development of terracing in river basins and do key development of hydropower resources in the upper reaches of the Huang He and the middle and lower reaches of the Chang Jiang, including the Chang Jiang Three Gorges and other large hydroelectric and nuclear power plants.

2) Establish a large nationally unified modern electric power grid. Peak regulation efficiency is high in large power grids, they are safe and reliable, and they can lower fuel consumption and reduce operating costs, so they have obvious benefits. The gradual achievement of automatic regulation of power grids, reactive compensation, rational allocation of voltage regulation equipment, rational selection of power grid peak regulation patterns, the completion and putting into operation of computer monitored and controlled power grid regulation systems and systemized planning of power grid regulation systems could be highly effective in regulating peak values, especially after the completion of 500 kV and 750 kV ultrahigh voltage power transmission lines, which could greatly expand the scale of power transmission and peak regulation.

3) Achieve a policy of preferential pricing for civilian electricity use. Because most residential electricity use for cooking occurs during a low peak in industrial electricity use, supply and demand for civilian electricity use can be met with little or no increase in generation capacity and the economic results of power plants can be improved. For this reason, other nations have implemented policies of preferential electricity prices for civilian use. Civilian electricity costs are lower than industrial costs, which encourages the people to use electricity. China does exactly the opposite, however. In the areas near hydropower stations in Jilin Province, the price of electricity for industrial use is only 0.03 yuan/kWh, while the price for civilian use is more than 0.10 yuan. The price of electricity for industrial use in Beijing Municipality is half that of electricity for civilian use. The state subsidizes coal gas and petroleum liquified gas for civilian use but gets high profits from electricity for civilian use. Table 3 shows a comparison of civilian electricity and coal prices in China and Japan.

Table 3. Comparative Civilian Electricity and Coal Prices in China and Japan

Electricity price, coal price	Japan (yen)	China (yuan)
Electricity price for the equivalent of 1,000 calories of thermal energy	21.03	0.197
Liquified gas price for equivalent of 1,000 calories of thermal energy	13.00	0.018
Coal price for equivalent of 1,000 calories of thermal energy	11.00	0.0046
Ratio of coal and electricity prices	2:1	40:1

We can see from Table 3 that there is a 40:1 ratio between civilian electricity and coal prices in China, while the ratio in Japan is only 2:1. It is estimated that, following changes in the electricity supply situation, China must change the electricity and coal price ratio and the price differential for industrial and civilian electricity use. Of course, some people feel that factories are under ownership by the whole people, but they are confusing "public" and "private." We feel that electricity prices should be calculated according to economic laws and the energy conservation situation.

4) We must popularize energy-conserving cooking utensils like electric cookers, infrared ovens, microwave ovens and so on. These cooking utensils conserve more than 20 percent compared to regular electric ovens, disperse little heat and are highly automated. With preferential prices, the people will be able to purchase energy-conserving cooking utensils.

Electricity is clean and convenient, can reduce the amount of housework done by the masses of [urban] residents and improve the health of the people. It has received support from the masses. Some people feel that Chinese people are unaccustomed to using electricity because they cannot use a roaring fire to cook their food. We know from restaurants run by overseas Chinese in other countries that Chinese food can be cooked on electric stoves. The customs, therefore, can change. Like washing machines and refrigerators, civilian electric cooking ranges will gradually gain wide acceptance as household electrical appliances develop.

5) Comprehensive planning, adaptation to local conditions, rational use of resources and energy, and gradual popularization of electric cooking utensils. Because of imbalances in energy, resources, technology and economic development across regions, there must be comprehensive utilization of all types of resources and energy. Civilian cooking is limited not only by electrification and coal gassification, but also involves problems of geothermal, solar and nuclear energy. According to predictions, civilian coal use will continue to grow up to the year 2000, so civilian coal use cannot be completely changed over to secondary energy sources. Therefore, in regions with the proper conditions like Zhongnanhai, Tian'anmen, and Beihai in Beijing and other key protected regions and regions with special requirements, in southwest China where electrical power resources are abundant, and in regions where the peasant masses have particular problems with fuel shortages, where vegetation has been destroyed and where soil erosion is serious, it would be inappropriate to continue to develop in the gradual progression of loose coal→ molded coal→coal gas→electricity as in foreign countries. We can centralize forces to build power plants and directly transform the millions of small coal stoves and wood stoves according to a program for civilian electricity use for cooking. This will eliminate the need to lay coal gas pipelines, reduce the number of problems, and thereby improve overall economic results. Areas without the proper conditions like places where loose coal is being used directly as a fuel should continue temporarily to extend the use of molded coal. The energy source for cooking and heating in most regions should combine electricity, coal gas, molded coal, geothermal energy, solar energy, nuclear energy and other energy resources to achieve

comprehensive and rational utilization. Achieving civilian electricity use for cooking often touches on a series of questions, including planning, capital, systems, prices and others. At the current time, we cannot universalize electricity use for civilian cooking because there is a national electricity shortage and because there are some areas that are not connected with power grids. It can be tried and extended in areas with the proper conditions, however, especially in those areas with abundant electric power resources and dense populations.

In summary, we feel that the environmental protection technology policy for civilian electricity use for cooking is: In those regions with the proper conditions, electricity should be the focus of civilian energy sources. There should be preferential pricing policies to popularize the use of electricity for civilian cooking and the use of energy-conserving utensils. When working to develop and utilize coal gas, natural gas, and petroleum liquified gas as energy resources, we must adopt pollution prevention measures. Gradually reduce civilian use of petroleum liquified gas and get rid of small coal stoves. In areas with abundant hydropower resources, we should develop small hydropower stations to supply electricity for civilian use. Such areas also can develop the use of electricity for peasant cooking. Areas with electricity and gas resource shortages can first develop in the direction of making a temporary changeover to molded coal (with desulfurization agent). Afterwards, in cities that are key state transformation points, we should set standards to prohibit the use of small coal stoves that burn coal as a direct fuel, as was done in England and America.

12539
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NATIONAL POLICY

THE DEVELOPMENT AND PROSPECTS FOR CHINA'S ENERGY ECONOMICS

Beijing SHULIANG JINGJI JISHU JINGJI YANJIU [QUANTITATIVE AND TECHNICAL ECONOMICS] in Chinese Vol 1, No 10, Oct 84 pp 3-7

[Article by Wan Lang [8001 3186]

[Text] Energy economics in China has developed greatly and achieved major results in the 35 years since the nation was founded.

1. There have been continual increases in the amount of known energy resource reserves.

A large amount of survey and prospecting work since the nation was founded has continually increased the amount of known energy resource reserves. China has 722.6 billion tons of known coal reserves[1] and we have discovered 380 million kW in latent hydropower reserves.[2] On the mainland, there is an area of 4.2 million square kilometers of sedimentary rock suitable for oil and gas exploration. There are more than 1 million square kilometers of continental shelf that is covered by less than 200 meters of water. A group of oil and gas fields have been discovered, and our known geological petroleum reserves are among the largest in the world.

2. The large increase in energy output has made China self-sufficient in energy and an energy exporter.

China's primary energy output in 1949 was only 23.74 million tons of standard coal, but had increased to 667.72 million tons by 1982, 28 times the amount in 1949 and an average rate of increase of 10.6 percent per year (see Table 1). Coal output in China exceeded 700 million tons in 1983, third highest worldwide. Petroleum output reached 106 million tons, seventh in the world. Electrical power generation reached 351.4 billion kWh, sixth in the world. Natural gas output reached 12.1 billion cubic meters, twelfth in the world. China has become the third largest energy producer in the world. We are not only self-sufficient in energy, but also export it. China exported nearly 20 million tons of petroleum and more than 7 million tons of coal in 1982.[3]

Table 1. The Development of Primary Energy Production in China

Year	Raw coal (100 million tons)	Crude oil (10,000 tons)	Natural gas (100 million cubic meters)	Electricity generation (100 million kWh)		Primary Energy output (converted to 10,000 tons of standard coal)
				Total electricity generation	Hydropower electricity generation (as part of total)	
1949	0.32	12	0.07	43	7	2,374
1952	0.66	44	0.08	73	13	4,871
1957	1.31	146	0.7	193	48	9,861
1962	2.20	575	12.1	458	90	17,185
1965	2.32	1,131	11.0	676	104	18,824
1970	3.54	3,065	28.7	1,159	205	30,990
1975	4.82	7,706	88.5	1,958	476	48,754
1980	6.20	10,595	142.7	3,006	582	63,721
1982	6.66	10,212	119.3	3,277	744	66,772

Source: China Statistical Yearbook, 1983.

3. Per capita energy consumption has increased.

Growth in energy output led to corresponding increases in energy consumption. Energy consumption in China reached 619.37 tons of standard coal in 1982, with per capita energy consumption of 610 kilos of standard coal, 13 times greater than the 1949 figure of 44 kilos.

4. Energy structures have improved.

Before liberation, the primary [energy source] was brush, stalks and other biofuels, making up 80.1 percent in 1949. The proportion of mineral fuels grew continuously following construction during the First Five-Year Plan. By 1958, biofuels had dropped to less than 50 percent, and China's energy structure entered a new period of development from that time on. Coal, oil, gas and hydropower have predominated since 1958. Coal as a proportion of commodity energy resources has dropped continuously, from 90 percent in the past to about 70 percent at the present time. There have been continual increases in the proportions coming from petroleum and natural gas (see Table 2).

Table 2. Changes in the Structure of Primary Energy Output in China

(figures in percent)

Year	Raw Coal	Crude oil	Natural gas	Hydropower
1949	96.3	0.7	--	3.0
1952	96.7	1.3	--	2.0
1957	94.9	2.1	0.1	2.9
1962	91.4	4.8	0.9	2.9
1965	88.0	8.6	0.8	2.6
1970	81.6	14.1	1.2	3.1
1975	70.6	22.6	2.4	4.4
1980	69.4	23.8	3.0	3.8
1982	71.2	21.9	2.4	4.5

Source: 1982 Almanac of the Chinese Economy

Energy development was damaged by the interference of the "gang of four" during the ten year period of chaos [Cultural Revolution]. The economic results of energy fell and there was a loss of proportion and disorganized management within the energy industry, causing startling waste. Energy development has taken a healthy road of development since the 3d Plenum of the 11th CPC Central Committee. Its main characteristics are:

1. Continual increases in national income and substantial improvements in the economic results of energy.

Since we began implementing the Central Committee's policies for reorganization of the national economy, the rate of increase in energy consumption has slowed, while the rate of economic development has remained high. In 1978, before reorganization, the nation consumed an average of 19.29 tons of coal for each 10,000 yuan in national income. After reorganization, this figure dropped to 17.93 tons of standard coal per 10,000 yuan in 1980, a decrease of 7.1 percent. The figure in 1982 was 16.36 tons of standard coal per 10,000 yuan, a decrease of 15 percent [since 1978]. In coefficients of the economic results of energy, each ton of coal created 518 yuan in national income before reorganization in 1978. After reorganization in 1980, the amount of national income produced by each ton of standard coal increased to 558 yuan, and reached 611 yuan in 1982 (see Table 3). The drop in energy consumption in national income has improved the coefficients for economic results of energy and conserved large amounts of energy resources. According to statistics on national income and energy consumption, some 110.90 tons of standard coal were being conserved in 1982 in comparison with 1978. Total conservation over the 4-year period between 1979 and 1982 amounted to 267.25 million tons of standard coal. This is a major achievement. It is due primarily to a rational reorganization of the proportional relationships among all sectors of the national economy, the enterprise structures and product structures within each sector, all types of decreased energy consumption, lowering the consumption of all types of raw materials, lowered costs and improved economic results.

Table 3. Changes in Energy Consumption in National Income Since the Third Plenum of the 11th CPC Central Committee

Year	National income from energy consumption (ton of standard coal/10,000 yuan)	Coefficient of economic results for energy (yuan of national income/ton of standard coal)	Total energy conservation during year (in 10,000 tons, compared with 1978)
1977	19.85	504	
1978	19.29	518	
1979	18.49	541	2,535
1980	17.93	558	4,572
1981	16.87	593	8,528
1982	16.36	611	11,090

Note: National income calculated according to constant 1970 prices.

2. There has been a fundamental improvement in the loss of proportional relationships within the energy industry.

After several years of reorganization, the amount of coal being developed, prepared and extracted has reached historical highs, and the tasks of the reorganization have been basically completed. The water content of oil wells and the rate of natural decrements in output have been controlled in some oil fields, and some areas favorable for oil and gas have been discovered within some older oil fields. The electric power industry has reversed the abnormal situation of operation at low cycles in the grid and low reservoir water levels. The best levels in history have been achieved in accident rates, coal consumption and other primary indicators.

3. Attention is being paid to the energy question, energy resource management has been strengthened.

The 12th CPC Central Committee made energy one of the key strategic points of economic development, and the energy question is receiving universal attention nationwide. The Central Committee, all regions, all departments and all enterprises have specialized organs and specialized personnel for energy management. The Central Committee also formulated the "principle of

combining energy development and conservation, placing energy conservation in the forefront in the short run, and developing reforms in the structure of the national economy and technical reforms with energy conservation as the core." These are effective guarantees for solving China's energy problems.

It must be soberly noted that China still has serious energy problems. There have been shortages in energy supplies on a national basis since the Second Five-Year Plan. There now are annual shortages of about 20 million tons of coal, 10 million tons of oil, and 10 million kW and 50 billion kWh of electricity. About 20 to 30 percent of the country's industrial capacity cannot be utilized because of energy shortages. There are serious energy shortages for household use in rural areas. More than 300 million peasants have no electricity and more than 300 million peasants do not have the fuel they need for living. The shortage of firewood has necessitated cutting trees and grass, which has caused damage to forests and vegetation, serious soil erosion and degradation of ecological cycles. In order to solve the energy problem and guarantee the need to achieve the magnificent goal of quadrupling the total value of industrial and agricultural output by the end of the century as proposed by the 12th CPC Central Committee, we should combine strengthened energy development with striving to conserve energy. We feel that there are optimistic prospects for both energy development and energy conservation. Energy development is, of course, important, but energy conservation is even more important.

According to predictions, China must invest about 700 billion yuan to increase national energy output to 1.2 billion tons of standard coal by the year 2000. We estimate that the state will be able to provide a total of 1.5 trillion yuan in investments by the year 2000. This means that energy investments will take up one half. Investments in the energy industry have amounted to an average of only 20.6 percent [of total productive investments] in the past. We must open up many channels to solve the capital problem in the future.

There will be problems in achieving energy output exceeding 1.2 billion tons of standard coal by depending on our national strength. We must clarify the question of the interrelationships between energy and economic development. Energy is a factor that restricts economic development, and this is entirely correct. Economic development, however, also plays a role in restricting the development of energy resources. In the past, we felt that economic development only required developing more energy, and that developing more energy would lead to faster economic growth. In reality, there is an optimum relationship between energy development and economic development, and there are problems of systems of benign cycles and non-benign cycles. For example, an increase of 600 million tons in energy output would require using all available capital. There would be very little for investments in other sectors, and economic development naturally would be affected. In turn, the effects on economic development would reduce the amount of investments available for energy. This would slow both energy and economic growth, and could lead to a non-benign cycle. If we focus on energy conservation, improve the economic results of energy, thereby conserving energy and reducing the burden of energy development, then economic results

of energy, thereby conserving energy and reducing the burden of energy development, then economic results will be improved, making more energy development possible. Further improvement of the utilization results of the energy that is developed also will conserve energy, reduce the pressure and burden on energy development, and provide more capital for energy development. If we enter this type of cycle, more and more energy development will lead to more and more energy conservation. Energy resources will be developed, as will the economy. Energy and the economy will not hold each other back, but instead will promote each other. This is a benign cycle of energy and the economy. It can be seen that energy development does not simply involve increasing amounts but must be done in an appropriate degree.

If we consider the problem of environmental pollution caused by energy consumption, it can be seen that just increasing energy development is not the best way (except for the foreign trade export of energy). China is consuming only 600 million plus tons of standard coal [annually], and there is very serious atmospheric pollution. According to data from a survey of 75 cities by related departments in 1981, one quarter of them exceed the minimum standards set by the state. The 75 cities had an average of 0.115 mg/m^3 of sulfur dioxide in the atmosphere, the value being more serious in northern than in southern cities. Acid rain also has appeared in some areas of the south. According to statistics from monitoring in 57 cities, an average of 37.7 $tons/km^2$ of particulate precipitation fell each month, almost double the minimum standards. The average value in 18 southern cities was 18.64 tons, but was 52 tons in 33 northern cities. The situation was much more serious in northern than in southern cities. This also requires the state to spend large amounts of capital to deal with the pollution. According to statistics from foreign countries, 10 to 20 percent of total project investments are devoted to investments in environmental protection. There is, therefore, a question of non-benign or benign cycles among energy consumption, environmental protection and economic development. If we promote energy conservation in China and adopt appropriate coefficients for growth in energy consumption, there will be no major increase in pollution from energy resources. This will permit the control of pollution from energy resources, and economic development and public health will not be greatly affected. It will be possible for the economy and society to develop smoothly, which is a benign developmental cycle of energy--economy--environment.

In view of China's national conditions, we must continue to focus more on energy development and less on conservation and environmental protection. This makes it difficult to precisely calculate energy use, leading to low economic results in energy, serious waste and severe pollution. Compared to the economically developed nations of the world, the value created by consuming a ton of standard coal in China is about one-half that in the Soviet Union, one-third that in America and one-fifth that in Japan. Comparing domestic markets within China, the amount of national income created by consumption of a ton of standard coal is highest in Shanghai, Zhejiang, Jiangsu, Hubei and other provinces, more than double the national average. The amount is below the national average in Henan, Hebei, Shandong and other provinces, and only half the national average in Shanxi. The differences and potentials are obvious.

China has been developing gradually in the direction of a benign cycle of energy--economy--environment since the 3d Plenum of the 11th CPC Central Committee, and we have achieved great results. While strengthening energy development in the future, we also must give preference to energy development in the future, we also must give preference to energy conservation. Only in this way will it be possible to achieve an excellent situation of major development of the economy, substantial energy conservation and major improvements in the environment by the year 2000.

According to our predictions, it would be best to control the coefficient of growth in energy consumption in the future to around 0.4 to 0.6. That is to say, if the coefficient of growth over the period from 1980 to 2000 is greater than or equal to 1, then we will need 1.96 billion tons of coal in 2000 and 8.5 billion tons of coal by 2030 (see Table 4). This would lead to a situation of low economic results for energy and increased environmental pollution and would affect economic development. Would it be possible if the coefficient of growth in energy consumption is around 0.4 to 0.67. We feel that it is entirely possible if we follow the lines, principles and policies since the 3d Plenum of the 11th CPC Central Committee. Table 5 shows changes in the coefficient of growth in energy consumption for the two periods before and after the 3d Plenum of the 11th CPC Central Committee. Practice over the period from 1979 to 1982 has proven that continual decreases in the expenditure of state income on energy consumption and continual improvements in economic results will make it entirely possible for there to be a fairly low rate of growth in energy consumption along with a high rate of economic growth. On a world scale, all economically developed countries have reduced the coefficient of increases in energy consumption since the 1973 world petroleum crisis. Table 6 shows changes in the coefficient of growth in energy consumption for the primary industrialized nations before and after 1973. Table 7 provides predicted values for the year 2000.

In summary, the energy industry in China has taken a healthy developmental path that is suited to objective needs and the future prospects are quite encouraging.

Table 4. Predicted Development of Energy Resources in China Under Different Coefficients of Growth in Energy Consumption (β)

Indicator	1980	2000				2030			
		β=0.4	β=0.6	β=0.8	β=1.0	β=0.4	β=0.6	β=0.8	β=1.0
(a) Average annual growth rate of national income (percent)	6.1	6.1	6.1	6.1	6.1	5	5	5	5
(b) National income (100 million yuan)	3,660	12,000	12,000	12,000	12,000	52,000	52,000	52,000	52,000
(c) Population (100 million persons)	9.83	12	12	12	12	14.6	14.6	14.6	14.6
(d) Percapita national income (yuan)	372	1,000	1,000	1,000	1,000	3,560	3,560	3,560	3,560
(e) Average annual rate of increase in energy consumption (percent)	2.9	2.44	3.66	4.88	6.1	2.0	3.0	4.0	5.0
(f) Energy consumption (100 million tons of standard coal)	6.03	9.76	12.4	15.6	19.6	17.7	30	50	85
(g) Percapita energy consumption	0.613	0.813	1.03	1.3	1.66	1.21	2.05	3.42	5.82
(h) National income for energy consumption (ton/10,000 yuan)	16.6	8.13	10.3	13	16.6	3.4	5.8	9.6	16.6
(i) Rate of decrease in national income for energy consumption (percent)	/	51	38	22	0	58	44	26	0
(j) Average annual rate of increase (energy conservation rate in percent)	4.0	3.5	2.4	1.2	0	2.9	1.9	1	0

Table 5. Changes in the Coefficient of Growth in Energy Consumption in China Since the 3d Plenum of the 11th CPC Central Committee

Indicator	before 1978	after 1978
	1953-1978	1979-1982
Average annual energy consumption growth rate	9.9%	2%
Average annual national income growth rate	6.0%	6.3%
Coefficient growth energy consumption growth	1.65	0.32
Energy conservation rate	-3.6%	4%

Table 6. Changes in the Coefficient of Growth of Energy Consumption in Major Industrial Nations after 1973

Period	Before 1973	After 1973
Country	1960--1973	1973--1978
U.S.	1.07	0.69
Canada	0.94	0.58
Japan	1.00	0.43
France	1.00	0.4*
Fed. Rep. Germany	1.06	0.96
Italy	1.81	1.15
England	0.71	0.55
Combined average	0.98	0.76

Sources:

1. Draft Report of the World Coal Research Society, Aug 1979
2. "Energy" (Japan), Dec 1982
3. "Energy" (Japan), Feb 1983

* Figure is for 1973-1981

Table 7. Predicted Coefficients of Growth in Energy Consumption for Some Countries of the World

Country	Coefficient of Growth in Energy Consumption
U.S.	0.43-0.78
England	0.35-0.57
Japan	0.70-0.71
Fed. Rep. Germany	0.57-0.58
France	0.77-0.78
Italy	0.73-0.82
Canada	0.69-0.86
Denmark	0.67-0.7
Finland	0.67
Holland	0.91-0.95
Sweden	0.38-0.5
Australia	1.17
World average	0.6

Source: "Energy Technical Economics", Hunan People's Press, 1982

* 1975-2000

FOOTNOTES

1. 1983 China Economic Almanac, pub. by the JINGJI GUANLI Press.
2. 1982 China Economic Almanac, pub. by the JINGJI GUANLI Press.
3. China Statistical Yearbook, 1983, pub. by China Statistics Press, 1983.

12539
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NATIONAL POLICY

ELECTRICITY PRICING CLOSELY TIED TO DEVELOPMENT OF POWER INDUSTRY

Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese No 11, 5 Nov 84 pp 2-4

[Article by Lei Shuxuan [7191 2685 5503]: "Electricity Rates, Long Depressed, Should Be Adjusted"]

[Text] In his government work report presented to the second meeting of the 6th National People's Congress, Premier Zhao Ziyang pointed out that "in speeding up urban reform, we should begin by tackling the relations between the state and enterprises, and between enterprises and their workers and staff. We should coordinate the various reform measures whose time has come and carry them out simultaneously." He added, "We must first sort out the relationship between the state and enterprises, striking a balance between ensuring stable and growing revenues for the state and ensuring a definite measure of financial power and managerial autonomy for the enterprises." Because pricing reform covers a large area and is a complex and sensitive issue, it is still in the study and preparatory stage but is expected to be inevitable once conditions become more favorable. Now that pricing reform has been put on the back burner temporarily, and rightly so, we have gained time to examine and explore the direction electricity pricing reform should take and draw up a reform plan. Electricity rates make up a component of energy prices. But energy, among other things, is curbing China's economic growth. Hence the tremendous significance of reforming the energy pricing system to boost the development of the energy industry and the electric power industry and promote electricity conservation. It is therefore both practical and urgent that we explore where electricity pricing reform is going.

1. Electricity Pricing Reform Is Closely Related to the Development of the Electric Power Industry

From the viewpoint of Marxian political economy and in the context of reproduction theories, electricity pricing is not an isolated pricing issue but a vital link in the reproductive process of an enterprise which tries to recoup its investments through commodity prices so that it can renew the reproductive process (and expand it). The price of a commodity like electricity is closely related to its value, that is, the socially necessary labor time. Naturally, it is also closely related to the costs of electricity generation, the prices of coal and petroleum and to material labor (the fixed

assets of generating facilities.) As a result, electricity rates are intimately related to accumulation in the electric power industry and the source of funds needed for reproduction expansion.

For 35 years, China's electric power industry has failed to meet the needs of national economic development. At present electricity output often falls short of demands by 15 percent. There are many reasons for this gap but the most important one is that the scale of reproduction expansion in the industry has not been able to keep pace with the growing electric demands of our national economy because the state has been reducing its investments in the industry. The total amount of taxes, revenues, and profits that the industry has turned over to the state over the past 35 years exceeded by a wide margin what the state has invested in it. The difference was sightly larger than the amount of plant investments we now need to close the gap between supply and demand. Since the electric power industry is a public utility, the state should not consider it a main source of revenue, like a light industry. Our long-standing electricity shortages result from this failure of the state to plow back into the industry most of its funds, minus the small amount which rightly goes to the state as taxes. Moreover, 35 years after liberation, electricity prices have basically been kept at their original levels. Because of the numerous preferential rates and changes in the mix of electricity consumption, the average price of electricity nationwide has dropped by one third compared to the immediate post-1949 period. Meanwhile, the prices of oil, coal and transportation charges have all gone up several times, with a severe impact on the costs of electricity generation. The marked decline in the profits rate of the industry in recent years, which is now lower than the average for all industries, mirrors the fact that electric rates are on the low side.

The above facts demonstrate that with its considerable capacity for development, the electric power industry can meet the needs of the national economy. However, our continued use of an accounting system which integrates revenues and expenditures and a planning system which is excessively centralized and has no room for the regulating effects of the pricing mechanism, has severed the continuity of expanded reproduction in the industry and failed to "ensure a definite measure of financial power and managerial autonomy for the enterprises." This is exactly one aspect of the dual problem Zhao Ziyang pointed out when he said that "we must sort out the distribution relations between the state and enterprises." In future urban reform, we must follow the principle of "striking a balance between ensuring stable and growing revenues for the state and ensuring a definite measure of financial power and managerial autonomy for the enterprises." Through tax and pricing reforms, electric power agencies should do a good job in managing the relations between the state and enterprises so that the two "ensurings" are actually achieved. Only in this way could the electric power industry gradually develop to the stage where it can meet the needs of national economic growth. This is the most valuable lesson in management and administration for the industry over the past 35 years and the first point we should bear in mind when we study electricity pricing reform.

2. Electricity Pricing Reform Should Go Hand in Hand with Energy Pricing Reform

The Central Committee has for long realized that energy problems are restricting China's economic growth and has taken many measures to solve them as soon as possible. Among these measures, the special tax on petroleum and the variously labelled charges on coal have already had some effects. Nevertheless, electric rates have basically not been changed; in fact, some electricity consumers are still enjoying concessionary rates. The result is a worsening electricity shortage. Meanwhile, newly developed rural towns are consuming more and more electricity at a time when the state can sink only so much additional investments in the electric power industry. The industry may borrow low-interest loans from the government or pool its resources, in which case it would have to consider its ability to repay the debt. The rising prices of coal and gas, which make up 75 percent of the costs of electricity generation, have pushed up such costs in recent years, thus reducing the industry's capacity to repay its debts. The way things now stand, the industry would be hard pressed to pay a capital construction loan within 15 years. And the longer the industry remains unable to borrow, the more tricky it will become for it to get loans from the electric power agencies. The industry's lack of construction funds in the past resulted in its losing one quarter of its productive capacity, which translated into an annual loss in national income of over 10 billion yuan. Consequently, it is both necessary and reasonable that electricity rates be adjusted at the same time as adjustments in coal and petroleum prices so that the electric power industry can maintain its ability to borrow and repay a loan. This is what most countries in the world do. In economic activities involving the exchange of commodities of equivalent value, not to adjust electric rates would only lead to greater waste because electricity would then be regarded as "cheap" and more severe shortages. In addition, the negative impact on the national economy would inevitably be doubled, resulting in incalculable economic losses.

Furthermore, electricity rates make up only a small percentage of the production costs of electricity consumers (with the exception of large consumers), ranging usually from 1 to 5 percent. The net rise in costs would be marginal if the increase in electricity rates can be offset by savings and conservation. Even more important, once the industry obtains funds for devleopment, it can increase its generating capacity which, in turn, would enable us to put into operation the one quarter of our industrial production capacity now idled by electricity shortages and increase the utilization rates of the production plants of electricity consumers, with a subsequent reduction in their costs which may partly or largely offset the rise in their electricity expenditures. Statistical data in some countries bears out these chain effects. To reduce the direct impact on people's livelihood, we can keep the rates for urban electricity (including domestic consumption) unchanged.

Let's take a look at energy pricing reform. It seems a "good" idea to use whatever income the electric power industry still gets from taxes and profits, at least in the books, to "absorb" "fluctuations" in the prices of

other energy resources so as to lessen the rippling effects on other sectors of the economy. But this is actually no more than an expedient measure and violates the economic principle of the exchange of commodities of equal value. It produces a superficial temporary moderating effect only to create a long-term problem later. This practice is in direct opposite to the spirit of electricity pricing reform. Instead of solving an economic problem, it will only worsen it so that electricity shortages will become more and more of a limiting factor on national economic development.

By properly developing our nation's electric power industry, we can reduce total energy consumption and promote conservation. Because of the higher conversion efficiency of electricity, a greater reliance on electricity in most cases will increase the energy utilization rate, with a corresponding saving in our total energy consumption. The most obvious example is the electric locomotive, which is about four times more efficient than the steam locomotive. But the existing gap between electricity supply and demand means that consumers cannot increase their electricity consumption in a rational way and have to depend on their fuel-inefficient equipment. This situation works against narrowing the gap between energy supply and demand and creates a vicious circle. A close analogy is provided by none other than the electric power agencies themselves. Lacking new fuel-efficient generating facilities, which can save more than 10 million tons of raw coal each year, they have no choice but to continue to use small and medium-sized, fuel-inefficient generating sets with a combined installed capacity of over 12 million kilowatts.

In short, it is in the nation's long-term interest to adjust agricultural and industrial electricity rates, to take suitable measures to promote the use of electricity and speed up the growth of the electric power industry. We must reject policies that offer only temporary "relief" but create future problems. It is only logical that electricity and energy pricing reforms be carried out simultaneously.

3. Electricity Pricing Reform Should Follow the Principle of the Exchange of Equal Values

Within the electricity pricing system, there are certain parts which have been made inappropriate by changing circumstances over the past 35 years. We should base ourselves on the new cost factors, integrate the characteristics of the production, circulation, distribution and supply of the electric power industry and follow the principle of the exchange of equal values. Prices should be strictly related to quality so that different categories of electricity consumers will be required to bear different electricity rates in a rational way. What merits our special attention is the two-part electricity rate system which acknowledges the fact that electricity production and consumption take place at the same time. Because of the influences of "leftist" ideas in the past, some departments and comrades who did not understand the system considered it irrational and complicated and suggested its abolition. Electric power cannot be stored in bulk. We can only maintain a certain amount of reserve generating capacity at all times to meet the sudden large demands of consumers. Since this need to keep a

reserve generating capacity has been met only with increased investments, it is only reasonable and necessary that large electric consumers thus served be asked to pay for part of the investments through the two-part electricity rate system. This system has worked well in China for more than 30 years and elsewhere and should not be abolished.

In the past, electric networks were so small that their energy requirements for generating electricity could basically be met from local sources. Even when local supplies fell short, the amount that had to be transported remained insignificant. Consequently, a uniform price structure has come to prevail throughout the nation south of Shanhaiguan, with the exception of northeast China. After three decades' developments, however, the energy supply situation has undergone fundamental changes. The coastal area now suffers from a severe shortage of energy resources and it is expensive to haul coal or oil or to deliver electricity over long distances. It is imperative for us to set differential electricity rates for different regions based on diverse generating conditions of different regional networks. By so doing we not only comply with the principles of the exchange of equal values, relating price to quality and of equal burden, but also facilitate the rational planning of large electricity consumers in accordance with the existence or otherwise of energy resources needed to generate electricity. This would lead to greater social and economic results.

Electricity used for lighting is at present more expensive than electricity used in agriculture and industry. But this is so only because the latter has been set at very low levels. The solution, therefore, is to reform electricity pricing by abolishing the various preferential rates enjoyed by agricultural and industrial consumers, gradually increase their electricity charges, reduce the disparity between them and domestic users, and stabilize the current domestic rates for an extended period to come (with the exception of domestic rates in the northeast where electricity for lighting purposes is extremely cheap).

Different electricity rates may be set for mountainous regions, valleys, dry areas and places which abound with water resources. But we must not rush headlong into this task. Our goals are practical results and reasonable burden. We must take into account the varying conditions in different localities, conduct pilot projects and then enforce the rate system gradually.

If the reform of the urban economic system is anything to go by, pricing system reform is just around the corner. It is hoped that reformers concerned with the electric power industry, particularly those comrades interested in studying electric pricing reform, would join together to explore the direction the reform should take and exchange research results and information.

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NATIONAL POLICY

URGENCY OF STUDYING ELECTRICITY PRICING DISCUSSED

Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese, No 11, 5 Nov 84, pp 5-10

[Article by Xu Yongxi [1776 3057 4406]: "Symposium Discusses Electricity Pricing Issues"]

[Text] The special committee on kinetic energy economics of the Chinese Electrical Engineering Scoiety held its first electricity pricing symposium in Beijing last March. About 70 people attended, including responsible comrades from departments concerned, writers on the problem of electricity pricing, technical personnel, and professionals in finance and accounting. They discussed and exchanged ideas on such topics as the level of electricity prices in China, and the pricing policy and system. We summarize below the academic viewpoints, research results, and ideas presented at the seminar.

1. The Importance and Urgency of Studying Electricity Pricing

Economic reform, the new technological revolution, our policy of making the electric power industry a vanguard industry, our objective of improving planning work -- all require that we intensify the study of electricity pricing.

1.) Pricing reform is an important part of economic reform. Since full-scale pricing reform is inevitable in China, we must closely examine and analyze the basis of electricity pricing and the direction of electricity pricing reform. Other questions are: How should electricity prices be adjusted after prices for other fuels are raised? In what ways would increasing electricity prices affect the prices of other commodities? From 1960 through 1982, electricity costs went up by 35 percent on average. In the same period, the rises in the prices of fuels, and depreciation costs pushed up electricity costs by 38, 6, and 9 percent respectively, or a total of 53 percent. It is only because of a drop in coal consumption, a decline in electricity consumption by plants and an increase in hydroelectricity, which reduced electricity costs by 12, 3, and 3 percent respectively, that we have been able to trim the increase from 53 percent to 35 percent. It is unlikely that coal consumption and plant electricity consumption will decline substantially in the future. Nor is it likely that the share of hydroelectricity will be increased other than marginally. The prices of fuels are still on the low side and upward adjustment is inevitable. For all these reasons, electricity price adjustment is a real problem that must be solved soon. (ref. 1, p. 17)

Pricing reform aside, economic reforms now underway, such as replacing capital construction appropriations with loans and requiring enterprises to pay taxes instead of turning over profits, will also have major impact on the level of electricity prices. These reforms have been tried out in the electric power industry and proved useful in raising management standard and economic results. But further improvements and coordination are needed. For instance, given our present electricity prices and surplus, electric power enterprises are unable to meet loan repayments as scheduled. In determining their tax rate, we must take into account the ability of the enterprises to pay back their debts.

2.) To be an economic vanguard, the electric power industry requires an adequate supply of capital construction funds. Such funds basically come from what the industry itself has been able to accumulate. But since industry accumulation is at present at a very low level, we cannot rely on it alone to bring about the kind of expansion and reproduction that we need to meet all our electricity needs. Therefore, a reasonable schedule of electricity prices and profit levels is basic to ensuring a reliable source of capital construction funds.

3.) Under our existing irrational pricing structure, the prices of commodities often have no relevance to their values. Because such irrelevance deprives the planning and calculation of national output value and national income of a scientific basis, we must make the examination and adjustment of our pricing system an indispensable part of improving our planning. Prices should fluctuate with changes in production factors, the supply and demand situation and evolving economic policies at the time. In drawing up a national economic plan, we should also formulate a price adjustment plan. China's average electricity prices have basically remained unchanged over the past 30 years. This must be adjusted soon. Henceforth, the adjustment of electricity prices, like the adjustment of the prices of other commodities, must be incorporated into the national plan.

4.) The hallmark of the new technological revolution is the information revolution. Its basic goal is to increase social and economic results. Only if we do a good job in adjusting prices could we further assess and increase economic results in all industries and trades and effectively meet the challenge of the new technological revolution by making good use of information resources.

2. Electricity Pricing Policy

A good electricity pricing policy demands that we skillfully handle the relations among the three parties: the state, electric power enterprises and electricity consumers.

1.) The electricity pricing policy should expedite the realization of China's strategic objectives and, through the pricing mechanism, contribute to the implementation of our energy policy and electricity development objectives. The electricity pricing policy should also be coordinated with economic and technical policies, including pricing, the utilization of foreign funds, environmental protection, electric power equipment and plants and the production and marketing of other related raw materials.

It is in China's general interest nowadays to end its widespread electricity shortages as soon as possible. If we can put the electric power industry on the right track, economic development will be well poised for take-off. This is a strategic measure for speeding up economic development. We must make electricity prices an incentive for groups and individuals to invest in the electric power industry. Hydroelectric prices should be fixed with regard to the investor's need to recoup his investments at regular intervals and to make a profit, which, in turn, will facilitate the accumulation of funds for the further development of the industry. Areas which lack resources for generating electricity should have an electricity pricing system which encourages conservation. In areas which have abundant hydropower resources or are temporarily hoarding electricity, prices should be lowered to make full use of the available electricity. A subsidy should be given to those industries which are electricity-intensive and have been operating at a loss for an extended period of time, provided they are allowed to continue production. They should not continue to enjoy preferential electricity prices. Such a change would help improve electric energy utilization results.

2.) The aim of the electricity pricing system should be to help the industry rely on its accumulation to achieve expanded reproduction. This aim has two implications. First, electricity prices and accumulation in the industry should strive for that golden mean, neither too low nor too high. Underpricing encourages wastes and leads to a shortage of funds in the electric power industry. Overpricing, on the other hand, will discourage all trades and industries from using electricity even when they should and encourage them to switch to other energy sources. Second, accumulation in the electric power industry should be plowed back into the industry for its own development and not be diverted to other purposes. This policy would do much to raise social economic results.

3.) Electricity is a commodity, the prices of which should be based on its value. We must follow the principle of the exchange of equal values. When the costs of producing electricity and the quality of electricity vary, the price of electricity should also vary. The electricity pricing policy should help eliminate equalitarianism in electric supply and allocate the total costs of electricity production rationally among its different kinds of consumers.

3. The Level of Electricity Prices

Discussion on the level of electricity prices was focused on the following two aspects:

1.) the theoretical basis for determining the level of electricity prices. Karl Marx pointed out many times that the value of a commodity is determined by the socially necessary labor time that goes into its reproduction. (See ref. 2, pp. 158, 448.) Owing to deterioration in the conditions of reproduction in the electric power industry, (for instance, elimination of old factories, the worsening production conditions of new electric plants, rising construction costs, rising fuel costs, etc.,) it takes an increased amount of socially necessary labor time just to keep electricity output at its existing level. Under such circumstances, electricity prices should be based on the new set of production factors, rather than the old.

In the general context of socialism, how should pricing accommodate the need for funds occasioned by expanded reproduction? This point has provoked much arguments in the realm of theory and must be solved in the real world. Under socialism, would commodity values be transformed into production costs? There is no consensus on this question. One view holds that such a transformation is impossible because the distribution of funds for socialist expanded reproduction is planned and has no room for competition and capital transfer. As a result, it is argued, commodity values can be decided in accordance with their socially necessary labor time. Another view contends that under socialist conditions, commodity values can be transformed into production costs. According to this view, the value of a commodity is created by a combination of the funds of socially necessary labor (fixed assets, circulating capital, etc.) and live labor. Under socialism, funds should be regarded as the accumulation of the consumption of labor. Consequently, in planning the distribution of capital construction funds, we must follow the principle of value. When we determine the profit level as part of the price mix, we must base outselves on the average social profit level.

Symposium participants believed that the latter view is more conducive to assessing and increasing the capital utilization rate, speeding up the circulation of funds, lowering the share of funds of a unit, and raising the social and economic results of enterprises, departments and society at large. Like other sectors of the economy, the profit level of the electric power industry should be based on the average social profit rate. In major industrial nations, electricity rates are also determined and controlled by the rate of return on capital. In the Soviet Union, for instance, the theoretical value of the rate of return in the electric power industry is 12 percent. It was increased in 1968 and 1982 by 15.9 percent and 12 percent respectively to bring it more in line with reality. In the United States and Japan, the major electricity suppliers are privately-owned utility companies. The government ensures a definite profit margin for these utilities through a "fair compensation rate" (a capital gains rate calculated in accordance with a complex formula including interest rates in the financial markets and the social demand for electricity.) With the capital gains tax, prices can be calculated by following the old formula, "costs plus profits." In most cases, the "fair compensation rate" yields enough funds for the private electricity companies to carry on expanded reproduction to satisfy the demand for electricity.

Their policy of guaranteeing a suitable price for electricity is an important reason why industrialized nations in both the East and West have been able to ensure an adequate supply of electricity.

2.) assessing China's present electricity price level and predicing its future trend. Concerning assessment, the discussion can be summed up in two points. First, looking back over the entire post-1949 period, the level of electricity prices has basically been reasonable. Second, in recent years, the level has been at the low end of the spectrum.

As mentioned above, the main yardstick for determining the level of electricity prices is the capital gains rate. Statistically, the average capital gains rate of the electric power industry from 1953 through 1983 has been slightly lower than, but still fairly close to, the averages for other industries. For historical reasons and other policy considerations, the surplus rates of individual industries cannot be identical with the average for all industries. With this point in mind, we could consider the surplus rate of the electric power industry basically reasonable. Further, let's take a look at the actual accumulation in the industry. Statistics show that if we had plowed back into the industry all the surpluses and taxes it had handed over to the state during the past 30 years, the industry's capacity to generate, transport and allocate electricity will be enough to satisfy all social needs today. For the 30-year period as a whole, the level of electricity prices has been basically reasonable.

In recent years, however, the capital surplus rate of the industry has been lagging behind the national average significantly. Increased fuel costs are mainly to blame. In the past 3 years, the increase in profits in the industry has been lower than one percent of the new capital funds, which fully demonstrates that electricity prices are depressed. This conclusion is confirmed by comparing the actual accumulation in the industry with its investment needs. To eliminate the effects of replacing appropriations with loans, levying taxes instead of demanding profits and increases in fuel costs, let's take 1980 as an example. Even had we devoted to capital construction all the profits and taxes paid by electric power enterprises run by the departments concerned and provinces, the industry would still have failed to meet the electric requirements of our growing national economy.

It can thus be seen that the profits level and price level of the industry, which were reasonable in previous years, have been depressed more recently.

Looking ahead, electricity prices are expected to pursue a stable but upward course. Prices will go up because of the functioning of the principle of values and the imbalance between supply and demand. (Some areas and enterprises with high output value have resorted to generating their own electricity at a cost of 0.3 to 0.5 yuan per kWh.) But the trend will be "stable" because of the need to avoid disruptive chain effects on the prices of other commodities. As a result of the lack of consensus on what would be an appropriate profit rate for the industry, there is no agreement in our assessments of the level of electricity prices. This diversity of opinion has affected policy-making in the area of electricity prices adjustment.

Electricity prices go up for three concrete reasons:

(1) increases in the costs of raw materials, freight charges and special tax. In 1982 alone, electricity costs went up 23 percent over 1981

(2) the capital profits rate of the industry need to be increased. To meet the requirements of the simultaneous growth of electricity production and agricultural growth and to realize the magnificent objective of quadrupling the total industrial and agricultural output value by the year 2000, the profits rate need to be increased to 14 to 15 percent. (See ref. 1, p 23-25)

(3) after increasing the tax rate on electricity and the categories of tax payable by that industry, we must also increase electricity prices to ensure that the industry would still be left with the necessary amount of profits. Given the dual need to avoid increasing prices too high and to ensure the profitability of the industry, we must consider such economic reform measures as replacing appropriations with loans and imposing taxes instead of asking for the handover of profits and other price changes in a comprehensive manner.

4. The Electricity Pricing System

The electricity pricing system boils down to one essential point, namely, the rational apportionment of the costs of electricity among the different kinds of consumers. It directly affects the structure of electricity prices.

Symposium discussions on the electricity pricing system can be summarized as follows:

1.) We should continue to adjust and improve the structure of electricity prices. With the permission of higher authorities and the cooperation of their vast numbers of consumers, electric power departments have taken effective measures to adjust and improve the structure of electricity pricing. For example, they have gradually narrowed the applicability of preferential rates, improved the method of adjusting electricity charges in accordance with the power factor, slowly increased electricity prices in energy-deficient which had been set too low and charging special rates to large consumers with plants in energy-rich areas. These measures have all produced notable economic results and should be intensified.

2.) We should step up research on and actively experiment with new measures which would increase energy utilization and economic results. Some examples: 1.) time-sensitive electricity pricing. This measure has been in effect overseas for several decades and found to be effective in reducing the disparity between periods of peak usage and low usage. Our low electricity prices and our serious restrictions on the use of electricity seem to obscure whatever advantages this method might produce. Nevertheless, there is a case for using it on a trial basis in suitable localities so that we can acquire the necessary experience and broaden its applicability. 2.) Differential rates for planned and unplanned usage. "Unplanned" electricity should be more expensive because of the high costs of fuels used in electricity generation. Enterprises should be required to pay higher prices for electricity in excess of what was already contracted for. Some electric companies in West Germany, for instance, charge three times as much 30 minutes after the scheduled peak load. 3.) Differential rates for different guarantee rates. The higher electricity supply guarantee rate is provided by a public electric network and should come with a higher price tag. The practice in foreign nations is to increase fixed electric charges instead of raising the electric charge with each additional unit consumed. 4.) Differential rates for rainy and dry season. To encourage consumers to use electricity during the rainy season,

we can charge lower prices than in the dry season. To make maximum use of water, we can make electricity prices even lower. In the dry season, on the other hand, the percentage of hydropower drops and the shortfall is offset by an increased reliance on thermal electricity. An increase in electricity charges during this period not only reflects changes in electricity costs but also promotes the use of hydropower. Some electric power companies abroad even offer extra low electricity rates temporarily during times when water supplies are exceptionally plentiful.

3.) Further research must be carried out to perfect the electricity pricing system. On the question of fixed electricity charges. Theoretically, the fixed cost of the basic electricity price should include fuel costs, wages and administrative charges as well as capital construction investments in fixed proportions. Capital construction investments should take into account not only existing plants but also new construction. The calculation of fixed electricity charges should also consider the time factor. At present, basic electricity charges make up only a small portion of China's electricity price mix. In fact, they have not changed over the past 30 years even though the electricity generating capacity and electricity consumption mix have become totally different from what they were in the early years of the People's Republic. We can rationally raise basic electricity charges in accordance with the above factors.

Concerning integrated electricity pricing, our present practice is to charge different rates for electricity for lighting purposes and electricity for power purposes. In the wake of economic growth and increasing demands for the latter kind of electricity, this practice has not only lost its capacity for improving economic results but also given rise to problems in some cases. Practically speaking, it is not workable anymore. Developed countries today have stopped installing different circuits for the two kinds of electricity or charging different rates. We should actively research the possibility of integrating them for pricing purposes. A pilot project may be carried out where circumstances permit.

Given the present state of our economy and technology, the more electricity we use, the more expensive electricity may become. Hence the proposal abroad for increasing electricity charges as consumption goes up. In 11 countries including Italy, this proposal has become a reality, although it is most applied to domestic consumers. For conservation purposes, we should closely study the feasibility and economic results of such an approach in China.

The direct exchange of electricity between two electric networks should be based on mutual benefit and the rational utilization of the energy resources of the state. When several electric networks located in different places buy and sell electric power through a joint network, the economic results of the joint network should be heeded. In the Soviet Union, the controlling office of the joint network is responsible for economic calculations. It buys electric power from the selling network in accordance with the latter's rates and sells to the buying network in accordance with the buyer's rates.

The seminar also discussed the two-part electricity pricing system and its applicability to China. Ever since it was first proposed in 1882, the two-part electricity pricing system has been adopted overseas for over 100 years and is in widespread practice in many countries today. After liberation, China also adopted the system and now has over 30 years' experience in it. Some localities considered doing away with it in 1971 to simplify the calculations of the amount of electricity consumed and electricity charges. Upon investigation, however, it was found that abolition would lead to wastes in the management of electricity supply and the unreasonable distribution of the burden of electricity costs. It was also found that in the absence of the two-part electricity pricing system, units which are fairly efficient in their management of electricity consumption would end up paying more. Consumers would be tempted to create an over-capacity in their electric facilities which, in turn, might lead the electric power departments to install more capacity than justified. For all these considerations, the two-part pricing system was retained. Theoretically, the two-part system is more rational than the uniform system, a fact which has been universally recognized. As for the actual standards to be used in a two-part system, they should be determined only after taking into account all the factors which affect electricity costs (maximum required capacity, consumption, load factor, current collector voltage class, the distances of power distribution, the number of current collecting points, the tolerance for temporary blackouts).

How applicable is the two-part electricity pricing system? In the early years of the People's Republic, it was applied to consumers of 50 KVA and above. This cut-off point was later raised to 100 KVA and to 320 KVA in 1975. Overseas there are two different approaches: 1.) Western industrialized nations apply the two-part system to all electricity consumers, including households, which use more than 40 KVA to 50 KVA. 2.) In the 1950's, the Soviet Union also took 50 KVA as the minimum for applying the two-part system. This figure was later increased gradually. Today the cut-off point is 750 KVA. The reason for increasing the minimum point, at a time when electricity consumption keeps going up, is to minimize the number of consumers to whom it can be applied so as to reduce the need for measuring instrumentation and calculating work. We must analyze the pros and cons of the above approaches and work out our own policy. Some areas are considering restoring 100 KVA as the minimum.

5. Ideas and Proposals

1.) There should be close cooperation among practicing professionals from finance and accounting, technical personnel, comrades engaged in scientific research and teaching and theoretical workers to undertake further research on electricity pricing theories and their laws of operations and further sum up our experience. Attention should be paid to overseas experience. According to a World Bank analysis, among developing nations, Brazil, Argentina, Thailand and Yugoslavia have a fairly well-managed electricity supply system. Their network losses are relatively limited and operating efficiency is quite high. This positive situation is related to their reasonable electricity rates. Other developing nations, however, experience electricity shortages; their electric network losses are higher and their electricity charges are lower. When we study foreign experience, we should examine developing nations as well as developed ones.

2.) The adjustment and reform of electricity prices should be examined from the perspective of economic reform. Right now China is implementing two vital economic reform measures, that is, replacing appropriations with loans and levying taxes instead of asking enterprises to turn over profits. Consequently, electricity price adjustment must be coordinated with these reform measures to ensure that the electric power industry is capable of both repaying its loans and meeting its tax obligations. As a matter of fact, the very idea of replacing appropriations with loans requires that the profits of the industry include what it needs to expand reproduction. The plan to impose taxes should accommodate the need by the industry to retain some of its profits for its own use. The level of electricity prices should acknowledge such needs.

The electric power industry provides a public service. This fact, plus the experience of other countries in running publicly-owned electric enterprises, suggest that we should keep our tax rate on the industry low and the categories of tax small in order to encourage its growth. We should make the industry profitable without making its product too expensive. Our tax rate on electricity was a low 2 percent before 1958, when it was increased to 5 percent. From 1965, the tax rate has been rising rapidly. Although this steep increase might be justified by immediate factors, it should be rolled back to about 5 percent for long-term considerations. As for the categories of tax payable by the electric power industry, we had only one in the past, namely the sales tax. In addition, it also collected local taxes. Public enterprises should not levy taxes on one another. In the United States and Britain, all electric power enterprises run by the federal or central government pay only a small tax to local authorities and no tax to the national government. Electric power enterprises run by local authorities are required only to bear part of the administrative costs of local authorities. In Britain, the amount of taxes paid by the Electricity Board to the local authorities makes up only 3.5 to 4 percent of its income from electricity charges. In the United States, the Tennessee Valley Authority is required to pay only 5 percent of its income from electricity charges to the local authorities. Also exempt from paying taxes to the central government are French electric power companies. The idea of imposing low tax rates on jointly owned electric power enterprises and adopting a no-tax policy is to let them keep their profits for expanded reproduction. This practice is conducive to developing the social economy.

Loans to the electric power industry should be long-term and low-interest. At present, the industry is required to bear the same interest rate as the textile industry. It is suggested that the interest rate for the electric power industry be lowered. A difference should be made between a capital-intensive, long construction cycle industry like electric power and an industry like textile which requires relatively little capital and has a short cycle. Furthermore, the maturing period of such loans should be lengthened to match the depreciation period. In both Britain and the United States, publicly-owned electric power companies are allowed to repay their loans over a long period of time, from 25 to 30 years.

3.) The accumulation of the electric power industry should basically be devoted to the development of the industry. Statistics show that a considerable portion of the industry's accumulation since the founding of the People's Republic has been diverted to other purposes instead of being plowed back into the industry. This is an important reason why we now have a serious electricity shortage problem nationwide. Experience suggests that as a public utility, the electric power industry should be allowed to "support" itself. In this way, we can solve the problem of insufficient funds in the industry without imposing a burden on the coffers of the state.

4.) We should determine a theoretical electricity pricing level and an ideal electricity pricing structure. With this as our goal, we should further work out a practical plan for adjusting and reforming electricity prices. Attention should be paid to the interrelations between electric prices and the prices of other commodities. Holding constant the total agricultural and industrial output value, the output volume of various products, consumption volume and taxes, the Water Conservancy and Economics Research Institute has calculated the theoretical prices of various products. In the United States, economists have worked out the share of electricity costs in the newly added values and producer prices of 20 major industrial products. (In the United States, newly added values are capital values plus labor values.) At the invitation of the Egyptian government, the World Bank undertook a study to find out the impact of increasing energy prices on national production and social livelihood. It was found that the chain effects caused by changes in electricity and energy prices are not as serious as previously thought. We should consider electricity price adjustment and reform as an economic tool for managing the economy and use it to promote the economic results of electric power enterprises and the consumption efficiency of electricity consumers.

5.) We should strengthen research on instruments that measure, record and monitor electricity consumption as a technical way of ensuring the implementation of our electricity pricing policy and system.

The symposium provided an opportunity for a tentative exchange of research results and academic viewpoints. We have achieved some understanding on certain issues and improved academic standards. Participants hoped that they could get together again after they have done some more work in order to contribute to the country's electricity pricing reform.

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12581
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NATIONAL POLICY

REFORM URGED FOR SHANXI ENERGY BASE CONSTRUCTION

OW081728 Beijing XINHUA in English 1631 GMT 8 Feb 85

[Text] Beijing, 8 Feb (XINHUA)--Reform is crucial to faster construction and development of China's biggest energy production base centered on Shanxi Province, according to a conference now in session here.

Covering 1.17 million square kilometers, the Shanxi base encompasses all Shanxi, northern Shaanxi and western Henan provinces, as well as western Inner Mongolia.

Verified coal reserves there are estimated at 505.5 billion tons--70 percent of the country's total. Four coal fields have reserves exceeding 30 billion tons each. There are also large reserves of bauxite, molybdenum and rare earths.

Faster construction of the base first required development across industrial and regional boundaries, agreed the conference called by the State Council's Shanxi energy base planning office.

Development plans should be better coordinated and balanced.

Joint initiatives by state, local government, collectives and individuals were stressed.

Energy and transport projects must be opened to investment from coastal areas and foreign firms.

Immediate priority should be given to smaller coal pits and other mines co-owned by townships and peasants, as well as to upgrading and expanding existing mines.

However, some large open-cut coal mines should be selected for development.

Since its establishment 3 years ago, the planning office has proposed key construction projects during the Seventh Five-Year Plan beginning next year.

It has also done feasibility studies for transport facilities in the area, particularly trunk railways.

A quality coal production and supply company has been set up. Plans have been drawn up for coordinated development of coal, water resources, power and aluminum in Shanxi and Henan provinces.

The Shanxi base mined more than 300 million tons of coal in 1984, about 40 percent of nation's total. It accounted for 80 percent of the country's coal supplies.

Iron and steel, machine-building, nonferrous metals, chemicals and building materials industries are growing rapidly in the area, according to the conference.

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NATIONAL POLICY

RURAL ELECTRIFICATION PIONEER PROJECT MAKES SOLID PROGRESS

OW270734 Beijing XINHUA in English 0701 GMT 27 Feb 85

[Text] Beijing, 27 Feb (XINHUA)--China has completed rural electrification plans for 100 pilot counties, according to the Ministry of Water Resources and Electric Power.

The first stage of construction of small hydropower stations has already started in 69 counties. The total design generating capacity of the projects under construction will be 370,000 kW.

The suggestion to choose 100 counties to pioneer rural electrification was put forward by party General Secretary Hu Yaobang in 1982 when he visited Fujian Province.

Since then rapid progress has been made. In 1984 alone, 120,000 kW in generating units was installed in the pilot counties.

About 67 percent of rural households in those counties already have electricity and the number of households using electricity in 26 counties has reached 90 percent. In Wenchuan County, Sichuan Province, every household is now using electricity.

Over 90 percent of food and animal feed processing in 66 counties is done with electric power and 91 counties are now developing electric cookers.

Altogether, China had 78,000 small hydroelectric power stations with a total generating capacity of 9 million kW by the end of last year.

CSO: 4010/98

POWER NETWORK

BRIEFS

NEW JILIN POWER LINE--On 10 January, the Jingbohu-Dunhua-Yanji 220-kilovolt power transmission line, the largest in Yanbian, Jilin Province, was put into operation. The power transmission line is 231.6 kilometers in length. [Summary] [Changchun JILIN RIBAO in Chinese 11 Jan 85 p 1 SK]

NEI MONGGOL 220KV LINE FINISHED--The 220,000-volt power transmission line between the Yuanbaoshan power plant and Daban in Bairin right banner, Nei Monggol Autonomous Region, was completed and put into operation on 7 February. The project covered by the state plan is the second high voltage line in the region. The total investment in this project reached 22.84 million yuan and its total length is 146 kilometers. [Excerpt] [Hohhot Nei Monggol Regional Service in Mandarin 1100 GMT 12 Feb 85 SK]

CSO: 4013/91

HYDROPOWER

HYDROPOWER DEVELOPMENT IN EAST CHINA POWER SYSTEM DISCUSSED

Beijing SHULI FADIAN [WATER POWER] in Chinese No 11, 12 Nov 84 pp 1-4

[Article by Jiang Ying [3068 5391]: "Probing Some Issues Concerning Hydropower Development in the East China Power Grid"]

[Text] Energy resources within the power supply area of the East China Power Grid are not abundant, but some hydropower stations with good conditions so far have not been developed and utilized. In recent years there have been a great deal of discussions and suggestions on hydropower development in the East China Power System. I will probe some of the issues and hope that these relationships will be correctly handled and will promote hydropower development.

I. Outlook for Hydropower Development in the East China Power System

Primary energy resources (coal, oil, hydropower) in the East China region are lacking and are unevenly distributed. Coal resources are primarily found in Shandong and Anhui while hydropower reserves are mainly in Fujian, Zhejiang, and Jiangxi. Economic development in this region is rapid and its demand for energy is increasingly great. Currently, coal and oil have to be brought in from elsewhere each year and in the future more and more energy resources will have to be brought in. The social labor consumption in transporting coal, oil and electricity (hydropower and thermal power) is higher than developing local energy resources. Consequently, speeding up the development of local energy resources is of great importance to economizing social labor consumption, saving capital construction funds, and easing the pressure on transportation.

Currently the East China Power Grid includes only the three provinces and one municipality of Jiangsu, Zhejiang, Anhui, and Shanghai. From the standpoint of the development trend of the electric power industry, Shandong and Fujian will gradually come under the East China Power Grid. The five provinces and one municipality have now developed an installed capacity of about 2.43 million kilowatts with an annual electricity output of 8.2 billion kilowatt-hours, equivalent to 26 and 23 percent of exploitable hydropower resources respectively. Although it leads the nation in the rate of development and utilization, three-fourths [of the reserves] have yet to be developed. With the construction of pumped-storage power stations, the outlook for hydropower that can be developed is bright.

II. Several Questions of Relationships

In the light of the characteristics of the East China Power Grid, we must pay particular attention to studying and handling some relationships as follows:

1. Relationship between power transmission from elsewhere and developing local hydropower resources. Because China's hydropower resources are primarily in the west and coal resources are primarily in the north, "transmitting electricity from west to east" and "transporting coal from north to south" are the only ways to solve the problem of energy resources for power generation in the East China Power Grid. In the future, along with the completion of the Gezhouba Dajiang power station and the Sanxia hydropower station, the development of hydropower on the Jinsha Jiang and the linkup between the Central China Power Grid and the East China Power Grid, transmission of power to east China will be gradually expanded. Does this mean that it is unnecessary to develop the hydropower resources in east China? I believe that "transmitting electricity from west to east" is necessary, but we must not relax on developing local hydropower resources. We must proceed in accordance with "transmitting electricity from west to east" and "transporting coal from north to south", construct nuclear power plants, restudy a rational development plan and development of hydropower resources within the East China Power Grid and formulate the corresponding developmental guidelines and policies. The reasons are: (1) East China is an economically developed region with rapid growth in agriculture, industry, and population. Early development may reduce losses caused by flooding. (2) Local hydropower resources are close to load centers. The distance of power transmission is short and can reduce transmission power loss. We can also utilize local labor, increase employment opportunities, make the economy of the areas around hydropower stations prosperous and give consideration to the demand on water for industrial and agricultural use. Although the scale of local hydropower stations may be smaller and investment per unit kilowatt and kilowatt-hour may be higher than central China and the southwest, if we add on the transmission power loss in "transmitting electricity from west to east" and the cost of power transmission and transformation projects, the two figures will be about the same. (3) The scale of hydropower stations is larger in the west with a higher total investment and longer construction time. It is also highly important for us to speed up the development of local hydropower stations and satisfy the short-term demand on electric power before realizing "transmitting electricity from west to east." (4) Gezhouba is a run-of-river power station and Sanxia is a seasonally regulated power station so that long-distance transmission of peak load is not economical. We must stress developing local hydropower stations with good regulatory capability in order to achieve the goal of satisfying short-term needs and long-term coordination with "transmitting electricity from west to east."

2. Relationship among electric power from coal, nuclear power, and hydropower. For the present and future, energy resources for power generation in the East China Power Grid primarily depends on coal and we must gradually develop nuclear power, does this mean that it might not be necessary to develop hydropower? I believe that a power system which depends mainly on coal and nuclear power complemented by a definite proportion of hydropower will have its might doubled and operations flexible. From the standpoint of the East China Power Grid, the generating capacity of hydropower stations can be appropriately larger. This is because the east China region is the most developed region in China. Along with the increasing popularization of household appliances, power consumption in municipal administrations and everyday life will sharply increase and the load rate will drastically decrease. As the peak-to-valley difference increases, the demand for reliability and quality of power supply will greatly increase so that a certain amount of hydropower is indispensable. Japan has basically finished developing its hydropower resources, but in order to continue to develop while maintaining a 20 percent ratio of total hydropower generating capacity in the total power generating capacity, it has incorporated the development of pumped-storage power stations in future planning. The East China Power Grid should also consider maintaining a certain proportion of hydropower in its forward development.

3. Relationship between regular hydropower stations and pumped-storage power stations. Generally speaking, before economic regular hydropower stations are completely developed, we should first develop regular hydropower stations before pumped-storage power stations. However, the peak regulation capability of China's large thermal power generating units is poor and the problem of inadequate peak regulation capacity is so acute that we may have to construct pumped-storage power stations ahead of schedule. Research on pumped-storage power stations in China has bearly begun and although the East China Power Grid is leading the research on pumped-storage power resources, it has not stressed research on mixed hydropower stations which combine regular hydropower stations and pumped-storage power. If we can learn from Japan's experience and pay particular attention to the feasibility of mixed hydropower stations and pumped-storage power stations, hydropower (including pumped-storage power stations) that can be developed within the East China Power Grid may be increased to several tens of millions of kilowatts. This can prevent irrational development of certain resources; moreover, with planning for mixed and pumped-storage power stations we can use them for comparison when we study "transmitting electricity from west to east" in order that there may be close coordination between power transmission and development of local hydropower and that the most rational program for power transmission and local hydropower development may be determined. We must therefore stress research on pumped-storage power stations.

4. Relationship between building new hydropower stations and expanding hydropower stations. Because of the East China Power Grid's large and urgent demand on peak regulation capacity, some people have advocated expanding the Xin'an Jiang Power Station and others advocated that we should first build the Tankeng, Huangpu, Shanxi, and Shuikou regular power stations. I believe that it is in-appropriate to draw a line between the two. Mainly we should decide on the basis of the demand for power consumption and economic benefits. In the early period of the founding of the state, the degree of hydropower development was very low and we had expanded the Shilongba and Xiatong hydropower stations left over from before Liberation. Later we also expanded the Jingbohu hydropower station and currently we are expanding the Shuifeng hydropower station. The amount of engineering work in expanding these power stations is small, their investment is not considerable and economic results are good. In recent years there have been consideration discussions on the issue of expanding the Xin'an Jiang power station within the East China Power Grid which can be summed up in two different expansion programs: First, changing all 9 of the roughly 70,000-kilowatt generating units to 100,000-kilowatts, increasing the installed capacity by 230,000 kilowatts. Second, drill additional tunnels, construct additional buildings and increase installation by 600,000 to 700,000 kilowatts. However, it has not been too long since the Xin'an Jiang Power Station began production. It would be a pity to adopt the first program and remove and change all the generating units, while the second program would involve considerable engineering, high investment, long construction time, and limited increase of electric quantity. Therefore, I believe that it is better to build regular hydropower stations, and based on an analysis of the specific circumstances in the East China Power Grid, it is better to first build the Shuikou, Tankeng, and Shanxi hydropower stations which will give us the capacity as well as quantity. As for expanding the Huangtankou and Gutian first cascade hydropower stations, we can do so in the near future if it is economically rational, but their role in power system peak regulation should be smaller.

5. Relationship among large, medium-sized, and small hydropower stations. The characteristic of hydropower resources in the east China region is that the proportion of large hydropower stations is small, the proportion of medium-sized stations is large, and the proportion of small stations is even smaller than large stations. Due to high losses by flooding, we may reduce the water level of large hydropower stations in the future and increase the number of cascades and as a result the number of medium-sized hydropower stations may increase. Large hydropower stations are funded by the state and built by the state's design and construction contingents; small hydropower stations are designed by prefectural and county water conservancy departments and built with collective funds from local authorities and the people and subsidized by the state. The construction conditions of these two types of hydropower stations are relatively practicable. However, the state cannot attend to medium-sized hydropower stations and small stations between 12,000 and 25,000 kilowatts

while local authorities are unable to bear the cost. Consequently, some medium-sized hydropower stations with rather advantageous conditions have never been developed. In recent years, concerned departments have started to pay attention to this problem, proposed setting them up jointly between central and local authorities and profit-sharing proportion to their investment, and have made a start in the joint construction of medium-sized hydropower stations. Recently they have also proposed the selection of construction units through bidding in order to lower construction costs. If these measures can be realized, the development of medium-sized hydropower stations in Zhejiang and Fujian may be accelerated.

6. Relationship between year-round electric energy and seasonal electric energy. Zhejiang and Fujian have a relatively high proportion of hydropower in the East China Power Grid. These two provinces also have a considerable number of small hydropower stations with considerable corresponding seasonal electric energy. The correct handling of the relationship between year-round electric energy and seasonal electric energy is an issue that urgently needs to be solved. When Gezhouba and Sanxia transmit power to the East China Power Grid in the future, a certain amount of seasonal electric energy must also be transmitted. In system planning and the balance of electric power and quantity, we must study the coordination among hydropower, thermal power and nuclear power and fully utilize the seasonal electric energy of hydropower stations. We must study the development of some seasonal consumers while suitably control the quantity of seasonal electric energy of hydropower based on the above conditions. Currently a more unanimous view is to differentiate the prices for year-round electric energy and seasonal electric energy based primarily on planned consumption and supplemented by price regulation. The procured seasonal hydropower electric energy in Japan is only about 10 percent of the basic price of electric energy. By adopting this measure, power supplying departments can lower the price of seasonal electric energy to attract seasonal consumers; this is also a restriction to the development of hydropower stations with low basic electric quantity and a high proportion of seasonal electric energy. Therefore, on the question of seasonal electric energy we should work along both lines. On one hand, as a policy we encourage in hydropower development the building of more hydropower stations that have regulation; and on the other hand we must have price differentiation so that we do not abandon the utilization of seasonal electric energy and we must not over-install for seasonal electric energy which cannot be utilized.

7. Relationship between water conservancy and electric power. How to give consideration to power generation, water conservancy, and other demands in comprehensive utilization is a question that deserves attention in the power supply area of the East China Power System. The central Anhui reservoir group has many reservoirs that are regulated once every few years and yearly. Hydropower stations have been constructed on these reservoirs for flood control and irrigation but

they have not fully played their role in power generation. Some comrades suggest that we study expanding the power installations of the central Anhui reservoir group and the question of the possibility for it to undertake peak regulation capacity of the system. Since there are truly too few reservoirs with good regulation function in the power area of the East China Power Grid while Meishan and Xianghongdian are reservoirs regulated once every few years and Foziling, Maojianshan, and Mozitan are reservoirs that are regulated annually or more frequently, we should adopt measures to fully utilize their regulation capacity.

8. Relationship between power generation and losses from flooding. In developing hydropower in the power supply area of the East China Power Grid we must pay particular attention to doing a good job in handling the relationship between power generation and population displacement and flooding. Since this area is economically developed and has a high population density and particularly valuable land resources, we should minimize flooding and displacement as much as possible. In the past we had always wanted to build several high dams and large reservoirs and fully utilize hydropower resources. In the late 1950's, for example, the Qingtian hydropower station in Zhejiang and the Jianxi hydropower station on the Min Jiang in Fujian had started construction but eventually these projects had to be abandoned because of losses from flooding which created considerable waste. Experience has proven that when losses from flooding are excessive and emigrants cannot be properly arranged for, demanding too much regulating function is meaningless and infeasible. We must sum up over 30 years of experience and lessons in hydropower development and minimize losses from flooding. We can adopt the method of building "faucet" reservoirs and implementing cascade development, compensatory regulation across drainage areas and protecting reservoir areas in order to correctly handle the relationship between power generation and losses from flooding.

9. Relationship in utilizing hydropower resources of rivers and tidal resources. East China is the region most abundant in tidal resources in the whole country. Many comrades therefore believe that we should stress developing tidal power stations. However, from the standpoint of technical and economic conditions, we should first develop hydropower resources of rivers and do a good job in building river cascade power stations and pumped-storage power stations in order to initiate the prerequisite conditions for developing tidal power stations. The disadvantages and advantages of tidal power stations are both prominent. The advantages are the absences of environmental pollution, the emigration problem and risk of economic losses from dam collapse. The disadvantages are low water head, difficult engineering, high cost, fluctuating and intermittent power generation as well as various interferences and restrictions. Tidal power stations are generally unsuitable for ports where there is a demand for flood prevention, drainage of flooded fields, keeping out tides and storing freshwater, and shipping. Therefore, the development of tidal energy must consider the demands of various quarters. Based on the conditions in China, we should at present intensify planning and research and do a good job in preparing for future large-scale development.

10. Relationship between the power system itself and local areas. The East China Power Grid currently spans three provinces and one muncipality. In the future it will grow to span five provinces and one municipality. At the same time when the power system is centrally managed we must do a good job in taking care of the interests of various provinces and regions. If we handle this relationship well we will be able to promote the development of hydropower.

III. Necessary Measures in Hydropower Development

1. Intensifying research on hydropower resources. In studying development plans for river cascades, we must study and analyze them in combination with pumped-storage power stations and further study the demands for comprehensive utilization and development plans to reduce losses from flooding and lowering construction costs. We should continually update the statistics on exploitable hydropower resources and development programs of regions. The general trend should be continual increase in the number of power stations that can be developed and their installed capacity.

2. Speed up the realization of incorporating the Fujian system into the East China Power System. Hydropower resources in Fujian are the most abundant in the power supply area of the East China Power Grid. Currently the total installed capacity of the Fujian Power Grid is 1,200,000 kilowatts, but because of the high proportion of small and medium-sized hydropower stations which are without regulating capability it is still difficult to supply a load of 600,000 to 700,000 kilowatts. If we can build the Shuikou hydropower station as soon as possible we can realize the incorporation of the Fujian Power System into the East China Power Grid; and if it cannot be built in the near future, in order to fully utilize Fujian's hydropower resources we should also do our best to link the two systems, make up for the shortages and speed up the development of small and medium-sized hydropower stations in Fujian. At the same time when the Fujian Power Grid is incorporated into the East China Power Grid we can also consider bringing the southern Zhejiang region under the East China Power Grid.

3. Develop large, medium-sized and small hydropower stations simultaneously, pay particular attention to developing and utilizing medium-sized hydropower stations. We can adopt the method of constructing medium-sized hydropower stations with the collective funds of central and local authorities and adopt effective measures to fulfill the survey, design, construction strength and sources and avenues of funds of medium-sized hydropower stations.

4. Study and restructure the system of electricity cost. We must regulate the prices for peaks and valleys, year-round electric energy and seasonal electric energy, regulate and reform the wholesale cost of electricity, and the internal accounting and pricing in the exchange of electric quantity between power systems and small hydropower stations in order to promote the development of the task of electric power construction.

5. Actively study measures to save investments, economize on the three materials and shorten construction time. From now on, the East China Power Grid will primarily build medium-sized power stations and cannot use the method of building large hydropower stations. We must adopt measures to lower construction costs in planning, design and construction management and suitably lower the standards and decrease the number of temporary projects.

9586
CSO: 4013/59

HYDROPOWER

SMALL HYDROPOWER CALLED 'STRATEGIC COMPONENT' OF ENERGY PLANNING

OW221349 Beijing Domestic Service in Mandarin 1200 GMT 20 Jan 85

[Text] The Ministry of Water Resources and Electric Power recently held a forum on the development of small hydroelectric power stations in Jiangxi, Hunan, Zhejiang, and Anhui provinces. The meeting, held in Nanchang City, Jiangxi Province, urged all localities in China to attach more importance and give support to the building of small hydroelectric power stations.

In order to accelerate rural electrification, improve the ecology and the environment, and ease the burden of major power grids, the forum emphasized that from now on, small hydroelectric power stations should serve as a strategic component of China's agricultural and energy development.

In view of various problems in the course of developing small hydroelectric power stations, the forum formulated some measures to support and promote small hydroelectric power stations. The primary measures include those to actively support and help small power grids connect with major power grids. After the linkup, major power grids should create conditions to buy as much as possible the power generated by small hydroelectic power stations during the high-water season, and to supply at preferential prices as much power as possible to small power grids during the dry season. According to the forum, it is necessary to implement the policy of managing and using small hydroelectric power stations by the builders, and a small hydroelectric power station may be returned to local management if the locality wants to take if back.

In her speech at the forum, Minister of Water Resources and Electric Power Qian Zhengying, called on all provincial electric power departments and the East China and Central China Power Administrations to seriously investigate cases involving their subordinate power supply organizations that have infringed upon the interests of small hydrolectric power stations in violation of government regulations. She urged them to firmly maintain local enthusiasm for operating power stations.

CSO: 4013/91

HYDROPOWER

BRIEFS

HUBEI SMALL-SCALE HYDROPOWER--Hubei's small-scale hydropower construction is flourishing. Last year, the province's small-scale hydropower total installed capacity reached 572,000 kilowatts and generated 1.22 billion kilowatt-hours of electricity, more than 65 percent of the power consumed by agriculture. The growth of Hubei's small-scale hydropower is largely the result of projects handled by the counties, districts and townships themselves. [Excerpt] [Wuhan HUBEI RIBAO in Chinese 28 Jan 85 p 1]

ZHEJIANG SMALL-SCALE HYDROPOWER--By the end of 1984, more than 5,700 small hydroelectric power stations, with a combined installed capacity of more than 627,000 kilowatts, had been built in Zhejing. Of these, 137 were newly built. Currently, 30 of the 62 counties and cities with small hydroelectric power stations have an installed capacity of more than 10,000 kilowatts. The installed capacity of more than 10,000 kilowatts. The installed capacity of seven counties tops the 20,000-kilowatt level. In 1984, small hydroelectric power stations throughout the province generated 1.4 billion kWh of electricity, representing 21 percent of the electricity used in agriculture last year. Departments in charge of water conservancy and power diverted water to those power stations located in areas with insufficient water resources, and carried out technical transformation of ill-equipped stations. They also built 13,000 kilometers of high- and low-tension power lines and trained over 6,000 personnel. [Summary] [Hangzhou Zhejiang Provincial Service in Mandarin 1000 GMT 21 Feb 85 OW]

CSO: 4013/100

THERMAL POWER

BRIEFS

QINGHE PLANT ADDS TWO UNITS--Shengyang, 13 Feb (XINHUA)--The new Chinese-made 200,000 kW power generation units at the Qinghe power plant in Liaoning Province, China's biggest thermal power plant, were connected with the grids here today. They increased the total design capacity of the power plant from 1.1 to 1.3 million kW and the annual power output from 7.5 to 8.1 billion kWh. [Text] [Beijing XINHUA in English 1843 GMT 13 Feb 83 OW]

FENGZHEN POWER PLANT COMPLETED--The Fengzhen power plant, a key project covered in the Seventh Five-Year Plan and directly arranged by the Ministry of Water Resources and Electric Power, was completed on 9 February. The installed capacity of the plant is 800,000 kw and it is equipped with four 200,000-kw generator sets. The ministry invested 630 million yuan in this project [Excerpt] [Hohhot Nei Monggol Regional Service in Mandarin 1100 GMT 12 Feb 85 SK]

WORK BEGINS ON ZHANGPING--On 20 November [1984] work began on Zhangping, a thermal power plant with an installed capacity of 200,000 kilowatts. After the Yongan thermal power plant, Zhangping is the next major state and province joint construction project. Zhangping will occupy 633 mu of land and in addition to the power plant itself includes a coal yard, environmental protection facilities and a special rail spur. The major portion of the earth work is expected to be finished by the end of 1985 and the No 1 100,000-kilowatt generator should be producing electricity before the end of 1986. After the entire project is finished the plant will generate 1.2 billion kilowatt-hours of electricity a year, providing power directly to Xiamen, Zhangzhou, and the Ying-Xia electrified railway. [Text] [Fuzhou FUJIAN RIBAO in Chinese 25 Nov 84 p 1]

HEILONGJIANG POWER PLANTS EXPANDED--In Heilongjiang, the Daqing Petroleum Administrative Bureau and the provincial Power Bureau will jointly invest in the expansion of the Jiamusi and the Liangzihe power plants whose current capacity is 290,000 kilowatts and 100,000 kilowatts, respectively. After expansion, the Jiamusi power plant will have two new generating units with a total capacity of 200,000 kilowatts, and the Liangzihe power plant will have a new generating unit with a capacity of 100,000 kilowatts. Expansion of these plants will be completed by 1987 and 1988. Eighty percent of the newly increased power output of these power plants will be used by the Daqing Oilfield and the remaining 20 percent by the province. [Summary] [Harbin HEILONGJIANG RIBAO in Chinese 28 Jan 85 p 1 SK]

CSO: 4013/96

COAL

1984 RECORD OUTPUT MAKES CHINA WORLD'S SECOND LARGEST COAL PRODUCER

OW250758 Beijing Domestic Service in Mandarin 0630 GMT 24 Feb 85

[From the "Sunday Lecture" program; radio talk by Gao Yangwen, minister of coal industry"--recorded; date and place not given]

[Excerpts] My comrades and friends: I will now give the people of the nation a report on the development of our coal industry.

In the past year, China achieved great success on all fronts of socialist construction. Our coal industry also achieved good results in production and construction. While fulfilling the production targets of the Sixth Five-Year Plan 2 years ahead of schedule, in 1984 we produced 770 million tons of new coal, 8 percent more than in the previous year. Our coal output surpassed that of the Soviet Union, bringing China from third place to second place in coal production in the world. Capital construction in the coal industry also speeded up. The production capacity of coal industry projects completed and put into operation in 1984 was the highest since the founding of the People's Republic.

Since the 3d Plenary Session of the 11th CPC Central Committee, we have followed the instructions of the CPC Central Committee and the State Council on emancipating the mind, seeking truth from facts, summing up experience and lessons from the past, and doing away with outdated ideas and restrictions, and have formulated new policies on developing our coal industry. These policies have encouraged the state, collectives, and individuals to make joint efforts to develop the coal industry and build large, medium- and small-sized coal mines.

In addition to building a number of large-sized key coal mines and improving some old mines, we have placed emphasis on carrying out more liberal policies and developing collective coal mines in rural areas. We have also encouraged individuals and all sectors to contract operating coal mines and to raise funds to develop new ones. Since the implementation of these policies, considerable results have been achieved by coal mines of various sizes, by those run by the state, collectives, as well as individuals. Coal mines in rural areas in particular have made good progress.

CSO: 4013/100

COAL

STATE MONOPOLY BROKEN, ANHUI'S OUTPUT RISES

OW290749 Beijing XINHUA in English 0721 GMT 29 Jan 85

[Text] Hefei, 29 Jan (XINHUA)--The Huainan and Huaibei coalfields in Anhui Province, two of China's eight major coal producers, have turned part of their resources over to local collectives or individual peasants, according to local mining administration.

At the same time, foreign investment is being sought to develop coal in the province.

The reform, which breaks the country's state coal monopoly, is aimed at improving efficiency and boosting output.

The Huainan and Huaibei coalfields have estimated reserves of 22 billion tons. Their production capacity is currently put at less than 30 million tons a year.

Formerly, all the mines were run by the Ministry of Coal Industry. Local collectives were only allowed to run relatively unproductive mines.

As part of its reform, the Huainan-Huaibei mining administration handed over to localities over four coalfields and a mine producing 3 million tons annually. It also gave local collectives and peasants permission to cut coal in abandoned mines and in areas around state-run pits.

Collectives and local peasants sank 32 small mines in 1984, contruction of several larger mines also got underway in the area.

Anhui produced 3.58 million tons of coal last year, twice as much as in 1980, and now no longer imports the fuel from other provinces.

Its state mines also boosted their output by concentrating funds, manpower, and materials on essential projects. Their output exceeded 20 million tons last year, according to officials here.

CSO: 4010/88

COAL

SHANXI POSTS RECORD COAL OUTPUT IN 1984

OW150755 Beijing XINHUA in English 0709 GMT 15 Feb 85

[Text] Taiyuan, 15 Feb (XINHUA)--Shanxi Province, China's top coal producer, reported a record output of 187.16 million tons in 1984, according to the provincial statistical bureau today.

This is 30 million tons, or 17.57 percent, more than in 1983 and exceeds the 164-million-ton target set for 1985, the last year of the Sixth Five-Year Plan.

The average annual increase between 1979 and 1983 was 12 million tons.

The bureau attributed last year's record increase to the new policy of encouraging collectives and individuals to mine coal along with the state.

The policy prompted rural collectives and peasants to start 504 small mines last year, bringing the total to 3,291.

Of these, 17 relatively big ones were upgraded or expanded with government loans.

Alotgether, mines run by rural collectives cut 70.65 million tons in 1984, nearly as much as state mines.

Shanxi has a verified 500 billion tons of coal, about 70 percent of the country's total.

CSO: 4010/88

COAL

REPORT URGES REFORM OF HENAN COAL INDUSTRY MANAGEMENT

HK080858 Zhengzhou Henan Provincial Service in Mandarin 1030 GMT 6 Feb 85

[Excerpts] The provincial people's government recently approved and relayed a report by the provincial Coal Industry Department on reforming the management system in the coal industry. It has decided to separate the functions of government and enterprises, streamline administration, decentralize power, and transfer all province-run coal enterprises to lower levels.

The report of the provincial Coal Industry Department is divided into five parts:

1. The functions of government and enterprises should be separated. Control of five province-run coal mines and two province-run coal industry machinery plants should be transferred to the cities and counties where they are located.

2. We should vigorously streamline organs and improve administrative style. The provincial Coal Industry Department must eliminate or reorganize the offices and sections which directly administer enterprises; strengthen the offices and sections which are in charge of overall planning, supervision, and examination; and switch itself from the administration type to business operations and service type.

3. More decisionmaking power should be given to coal enterprises in nine fields including personnel, labor and capital, planning, production, supply, and marketing.

4. We should change the administrative companies directly under the provincial Coal Industry Department and the grade 2 companies which combine the functions of government and enterprises into enterprise-type companies which carry out business operations independently.

5. We should strengthen trade management and establish trade associations.

CSO: 4013/96

COAL

NEW USES SOUGHT FOR STONE COAL, GANGUE

Beijing GUANGMING RIBAO in Chinese 14 Dec 84

[Article by Luo Shengmei [5012 4141 5019]: "Technical Service Center Established To Develop Stone Coal"]

[Summary] To promote the use of low-grade fuels in electricity generation and the comprehensive utilization of ash, the Yiyang Stone Coal and Gangue Development and Utilization Technical Service Center has recently been set up in Changsha under the Hunan Science and Technology Commission. The center will popularize the new scientific achievements of the Hunan Yiyang Pilot Plant on the Comprehensive Utilization and Electric Generation of Stone Coal, provide new technology for the development of such low-grade fuels as stone coal, gangue, and oil shale and help train technical personnel.

After years of research and experimentation, the Hunan Yiyang Stone Coal Power Generation and Comprehensive Utilization Pilot Plant succeeded in developing a stone coal 35T/H fluidized-bed boiler and its associated 6000kW steam turbine generator. This success was an international innovation. In 1984 the State Council decided to popularize this technology and build an installed capacity of 1 million kilowatts.

China's stone coal deposits amount to 62 billion tons, of which over 1 billion tons have been excavated during coal-mining operations. The full utilization of this and other low-grade fuels has significant implications for reducing the disparity between energy supplies and demands in China.

12,581
CSO: 4013/69

COAL

BRIEFS

NORTHEAST RESERVES REPORTED--Last year, the Northeast China and Nei Monggol Coalfield Geological Bureau verified 610 million tons of coal reserves in Northeast China and Nei Monggol. In addition, they also discovered new coal resources in Harqin Left Wing Mongol Autonomous County and Yixian County of Liaoning, in Tonghua, Jilin Province and in Jixi, Heilongjinag Province. [Text] [Shenyang LIAONING RIBAO in Chinese 6 Feb 85 p 2 SK]

HENAN 1984 OUTPUT--In 1984, Henan produced a total of 69.33 million tons of coal, an increase of 5.31 million tons over 1983. This was the biggest annual increase since the liberation. The number of township coal mines developed to 1,400 during the year and a large number of mines operated by individuals appeared. Local coal mines produced 48 percent of the province's coal, compared with 44.6 percent in 1983. Collective coal mines produced 23.8 percent of the total output. [Summary] [Zhengzhou Henan Provincial Service in Mandarin 2300 GMT 16 Feb 85 HK]

NEI MONGGOL 1984 OUTPUT--Since the beginning of 1984, the coal industrial enterprises have greatly increased their output thanks to readjusting their leading bodies, and enforcing the responsibility systems. In 1984, they turned out 8.18 million tons of raw coal, dug more than 7,300 meters of tunneling footage, and prefulfilled the annual production and tunneling plans by 8 and 53 days respectively. [Excerpts] [Hohhot Nei Monggol Regional Service in Mandarin 2300 GMT 4 Jan 85 SK]

JILIN 1984 PRODUCTION--In 1984, local state collieries of Jilin Province produced over 4 million tons of raw coal, overfulfilling the production plan by 590,000 tons and showing an increase of 500,000 tons over 1983. [Summary] [Changchun JILIN RIBAO in Chinese 25 Jan 85 p 1 SK]

SHANXI 1984 COAL OUTPUT--Shanxi Province produced 184.61 million tons of coal last year, overfulfilling the target of 164 million tons set in the Sixth 5-Year Plan. Output rose by 26.11 million tons over 1983 and some 123.69 million tons were shipped out of the province, an increase of 17.71 million tons over 1983. Of this, 108.02 million tons were shipped by rail and 15.67 million tons by road. The number of township mines in the province rose from 2,787 in 1983 to 3,291 last year, and by the end of the year the production capacity of these mines had risen to over 80 million tons compared with 53 million tons the previous year. These mines actually produced 70.65 million tons during 1984, compared with the year's target of 46 million tons. [Summary] [Taiyuan Shanxi Provincial Service in Mandarin 2300 GMT 12 Feb 85 HK]

NEW MINE NEAR USSR BORDER--Hohhot, 28 January (XINHUA)--A new coal mine producing 450,000 tons of high quality brown coal a year has gone into operation in the Inner Mongolia Autonomous Region bordering the Soviet Union. It is in Borxil coalfield in northwest Inner Mongolia, where deposits are verified at 10.4 million tons, regional officials here said. [Text] [Beijing XINHUA in English 1443 GMT 28 Jan 85 OW]

CSO: 4010/90

OIL AND GAS

CNOOC SEEKS COOPERATION WITH TAIWAN

HK310244 Beijing XINHUA Hong Kong Service in Chinese 0635 GMT 30 Jan 85

[Report by Zhang Chengzhi [1728 2110 1807]: "Chen Bingqian Says China National Offshore Oil Corporation Desires To Cooperate With Taiwan Oil Companies in Expoliting Offshore Oil"]

[Text] Beijing, 30 January (XINHUA)--Chen Bingqian, spokesman for the China Offshore Oil Corporation, stated at a news briefing today that his corporation desired to cooperate with any oil company from Taiwan in exploiting offshore oil

Chen Bingqian made this statement when asked by reporters whether oil companies from Taiwan were welcomed to join in the offshore oil bidding.

Chen Bingqian added: We will extend a warm welcome to representatives from any Taiwan oil company coming to discuss any cooperation project with us.

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OIL AND GAS

PRODUCTION AT ZHONGYUAN FIELDS COULD QUADRUPLE BY 1990

Beijing RENMIN RIBAO in Chinese 3 Dec 84 p 1

[Text] According to a report in HENAN RIBAO, satisfactory changes in oil field construction and production have come about as a result of efforts by the party committee of the prospecting bureau at Zhongyuan oil fields and related organs at all levels to integrate realities into party rectification. By upholding high standards and making stringent demands, they have stimulated enterprise rectification and reform. Among the changes are the following.

There has been an increase in the consciousness of the people to act in unison with the CPC Central Committee. They are now more determined to quadruple crude oil output by 1990 and more confident that this could be done. The mass of party members have deepened their understanding of the party's principles and policies through education on party rectification. The party committee of the bureau measures its political consistency with the Central Committee by the degree of thoroughness with which it enforces the key instructions and directives issued by the central leading cadres on the development of the petroleum industry. It has revised the oil field development plan twice. The Ministry of Petroleum Industry has demanded that the oil field increase its crude oil output to 10 million tons by 1990; the bureau party committee is striving with all its might to produce 15 million tons. In September 1984, the bureau assigned to No. 2 drilling company a drilling task with a combined footage of 90,000 meters, all involving deep wells. In the past, the company used to worry that it would not be able to complete a job. After self-analysis and examination, its leadership shook off its former fear of difficulty and encouraged its people to press ahead in the face of hardships and exert themselves to their utmost so that they could accomplish more than is required. The continuous downpours some time ago made the ground so soggy that drilling rigs were immobilized and failed to operate. To protect the frontline, a

general mobilization was declared to drain off the water and repair the roads. After a massive effort involving 800 men, they finally accomplished the October task of drilling 11,000 meters 2 days ahead of schedule. Both the 4558 brigade and the 4521 brigade set a record by taking 200 days less than they did the year before to complete two deep exploratory shafts.

Moreover, party rectification has raised production significantly. This year's plan calls for the sinking of 375 wells and a drilling footage of 95,000 meters. From January to September, 80.7 percent and 89.4 percent respectively of these two tasks were completed. Compared with the same period last year, these figures represent increases of 54 percent and 34.9 percent respectively. More crude oil and natural gas were produced than in the corresponding period in 1983, the former by 38.9 percent, the latter by 34.3 percent. The No. 1 drilling company fulfilled its 1984 production quotas 68 days ahead of schedule. Drilling footage also exceeded last year's figure by 67 percent.

Enterprise rectification and reform have also been given a boost. In rectifying the party, party organs at all levels at the oil fields made structural economic reform their focus and boldly experimented to simplify the organization, initiated vertical and horizontal contracting systems, instituted a flexible wage system, and, by integrating party rectification with enterprise reforms, improved management at the enterprise. Earlier, the departments concerned examined rectification in 15 units. Apart from one which was relatively inferior, all others were approved and awarded certificates. In the past, the oil construction company was grossly overstaffed. During rectification, it trimmed its staff drastically in accordance with needs and abolished 8 administrative and technical offices overnight. In July, it introduced a 100 yuan output value contracting system which has produced some very notable results over the past three months. First, there has been a greater delegation of authority, restrictions have been relaxed and the grassroots has been given more autonomy. Second, it has facilitated the organization of production on a quota basis with a fixed number of personnel. Third, the company has heightened cadres' and workers' sense of responsibility and stimulated their enthusiasm and creativeness. The company has entered 1985 96 days earlier. The oil testing office has launched horizontal and vertical contracting systems to farm out work to the grassroots, rewards those who overfulfill their quotas and punishes those who fail to finish their tasks and increases bonuses. As a result, a new phenomenon has emerged in which grassroots units compete for assignments and make every minute count. Workers have become more meticulous in their budgeting and accounting. Their attendance records have improved and they fulfill their share of work. Also they have become more safety- and quality-minded.

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OIL AND GAS

INCREASING OUTPUT AT LIAOHE FIELDS

Shenyang LIAONING RIBAO in Chinese 6 Dec 84 p 1

[Article by Zhang Shirong [1728 0013 2837], Wang Houti [3769 0624 7555]: "Petroleum Geology Expert Makes Major Contributions to Oilfield Development"]

[Text] Deng Lirang [6772 4409 6245], formerly Liaohe petroleum prospecting bureau chief and now party secretary of the same bureau, has worked long and hard to master petroleum geology. A leading comrade on the State Council has praised him as an expert in that discipline. For the past few years, thanks to his strong geological background, he has made a number of significant and correct decisions regarding prospecting at Liaohe oil fields, desptie complex geological circumstances. He has done much to bring about a new production phase.

Deng Lirang has successively taken part in the development of seven oil fields including Yumen, Daqing and Shengli. This long involvement has convinced him that petroleum prospecting and development is a very difficult subject which takes much more than drive and enthusiasm. One can give one's decisions a scientific basis only by learning and mastering professional theories and knowledge. After joining Liaohe fields in 1977, he was confronted with its complex geological conditions and decided to make petroleum geology the focus of his studies. Deng Lirang has three study methods. First, he seizes every available minute to read and study such college specialized texts as "Petroleum Geology" and "Sedimentology" to obtain a systematic understanding of professional theoretical knowledge. Second, he learns from experts. In the past few years, he spent most Sundays listening to lectures by experts whom he had invited for this purpose. Third, he learns from practice. He often penetrates deep into a well site to examine the rock core and logging data to enrich his knowledge.

After more than 10 years of prospecting and development, we have basically discovered all structural oil deposits at Liaohe fields which are easily accessible. For three consecutive years, prospecting

has failed to turn up any major discovery. Some people believed that Liaohe fields have run dry and suggested that they be abandoned. Relying on his extensive geological knowledge, Deng Lirang concluded that the Liaohe oil fields have not gone dry. It is just that we still do not understand many geological phenomena and have yet to explore much oil-bearing territory. After presiding over a party committee meeting to work out a consensus, he made important changes in the strategic plan of the oil fields and put forward the key policies of emphasizing prospecting and relying on new technology to turn up hidden oil wealth. This was followed by the successive discoveries of such hidden oil deposits as the anticline and Guqianshan and several new oil-bearing areas including Shuangtaizi. The Ciyutuo and Shenyang oil areas, where prospecting has largely been fruitless in recent years, have both made spectacular progress.

For many years, China's oil field development has followed the old formula of prospecting first, development second. In opening up the Huanxiling oil field, Deng Lirang broke with tradition, despite opposition from individual leaders, and put his scientific knowledge to work. He proposed the clear policy of "integrating prospecting with development." In this way, he speeded up the pace of development and increased the daily crude oil output from 2,000 tons to over 9,000 tons. Deng Lirang's integrated approach has enriched our experience in the development of fault block oil fields.

12581
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OIL AND GAS

REINFORCING SEISMIC EXPLORATION IN EASTERN CHINA

Baoding SHIYOU DIQIUWULI KANTAN [OIL GEOPHYSICAL PROSPECTING] in Chinese
No 5, Oct 1984 pp 397-404

[Article by Yuan Bingheng [5913 4426 5899], Tan Shidian [6223 6107 0368] and Liu Qiusheng [0491 4428 3932]]

[Text] Abstract

Eastern China is a relatively mature area in petroleum exploration and has produced a large amount of oil and gas. This is the most realistic area at present for expanding oil and gas reserves and rapidly improving output capacity. The geological structures, lithology and lithofacies in the area are quite complex and variable, making seismic work quite difficult.

We offer the following proposals for obtaining greater oil and gas reserves over the next few years based on regularities in oil and gas distributions and the characteristics of geological structures in the petroliferous areas of eastern China: 1) Using new forms of thinking to evaluate petroliferous trap zones; 2) Increasing the accuracy of field data, careful processing and formulation of accurate structural maps; 3) Extending the use of 3-D seismic surveys and vertical seismic profiling.

Introduction

The oil- and gas-bearing region in eastern China covers a vast area east of Daxing'anling, Taihangshan and Wulingshan and north of Nanling. The area contains more than 40 Mesozoic and Cenozoic basins. Some of them, including the Songliao, North China, Jianghan, Nanyang, Biyang and Subei basins, have been proven to contain rich oil and gas resources and are the primary oil and gas producing regions in China at the present time. Exploration has been carried out in the region over a fairly long period, and it is a relatively mature exploration region in domestic terms. The level of exploration is still very low compared to fully-explored areas in other countries, however. Only 20,000 wells have been drilled in the

region up to now, an average of one well for every 40-plus square kilometers. This figure is only one well for every 20 to 30 km^2 in the North China basin where more wells have been drilled. In comparison, more than one million wells have been drilled in the U.S. Gulf of Mexico, an average of one well every 1.4 km^2. The average in Texas and Louisiana on the continent is one well every 1.3 km^2. It is estimated that 30 to 40 percent of the oil and gas resources in that area have not yet been discovered. Little work has been done below 3,000 meters or around old oil fields, and we have just begun to search for oil and gas pools in deep strata or under complex storage conditions, so there is obvious potential that can be exploited. If we conscientiously, meticulously and thoroughly analyze regularities in oil and gas distributions in these oil and gas pools, we will be able to discover more oil and gas pools more quickly. There must be new patterns of thought, new techniques and new spheres of exploration for dealing with the complex and variable geological structures in the region so that more resource reserves can be provided.

I. Geological Structures in the Sedimentary Basins of East China

The intense subduction of the Kula-Pacific plate to the west since the Mesozoic and Cenozoic caused the different geodesic structural components to be controlled by the Biwufu belt, forming a unified zone of extension activity at the continental margin. The continental margin was transferred from an Andes mountain-type structure in the Mesozoic to an island arc--marginal sea form in the Cenozoic. For this reason, the sedimentary basins were formed on a background of extension and are predominantly rift valleys with obvious block fault subsidence. The intense block fault subsidence caused the basin structures to form grabens or half-graben/half-horst structures that were accompanied by sedimentation. This created a situation of multiple depressions and uplifts that profoundly influenced the structures and sediments in the basins.

1. The basins contain complex interlocking fault systems.

Because the basins were produced by block fault subsidence, the effects of localized tension and extension, overcompression of mudstone and igneous diapirism formed a series of slipping normal faults that developed concurrently with the sedimentation. These faults not only controlled the formation of depressions and uplifts, but also created a great variety of morphologically-distinct regional structures. These regional structures often were made more complex by the faults. The second-order structures are usually represented on structural maps as a closely-spaced web of dense fault belts. Many faults can be seen in seismic profiles of the tops of the structures. There are several faults per kilometer, and there may even be several faults in a distance of only 100 or 200 meters. This not only destroyed the integrity of the regional structures but also the consistency of the strata above and below the structures. It is quite difficult to delineate the scope of structural belts, and there often are various types of fault block traps outside the structures.

These large numbers of faults are often matched with unconformity surfaces and various types of accumulation bodies, forming a three-dimensional system of oil and gas migration paths. The oil and gas migrated vertically along the faults up to the capping strata and may also have formed secondary oil pools.

The oil and gas pools often are dissected by faults, forming complex oil, gas and water distributions. There are many pressure systems, many fluidic qualities and many forms of drive.

2. Multiple periods of rifting-subsidence formed many unconformity surfaces.

Five or six regional Tertiary unconformity surfaces may be found scattered across the North China Basin: between the Minghuazhen and Guantao groups, the Guantao and Dongying groups, the Dongying group and Sha 1 member, the Sha 1 and Sha 2 members, the Sha 3 and Sha 4 members, the Sha 4 segment and Kongdian group, and so on. Five unconformity surfaces also developed in the Gaoyou depression in the Subei Basin during the Mesozoic and Cenozoic. Some local areas may have even more unconformity surfaces, such as the three unconformity surfaces that can be found within the Sha 4 member and the Kongdian group on Niubei slope in the Langgu depression. There also are two local unconformity surfaces and five sediment discontinuity surfaces in Cretaceous strata in the Jianghan Basin's Qianjiang depression.

The existence of these unconformity surfaces led to repeated progressive and regressive capping of the sediment strata, as well as to discontinuity between the upper and lower structural strata and migration of the high points. As mentioned previously, these unconformity surfaces not only played an important role in oil and gas migration, but even more important was a long period of hiatus, erosion and dissection that created all sorts of favorable traps in the structures above and below. Examples include the ancient buried hill oil pools found in every depression in the North China Basin, the unconformity oil pool in the Jiyang island arc, and so on.

3. The multiple sedimentary systems created many types of reservoir rock bodies.

The many depressions and uplifts in the basins of east China have the special characteristics of multiple material sources and multiple sedimentary systems. There also were different sediment sequences during different stages of their development. For this reason, there are many types of accumulation bodies in the east China Basins, the main ones being deltas, submarine alluvial fans, deepwater river channel sands, sheet sands, bioclastic limestone, reef limestone, and so on. Moreover, the Paleozoic and middle and upper Protozeroic dolomite and limestone in the ancient buried hills and the drift beds, culluvial conglomerates and granite weathered crust above them also have been proven to be excellent reservoir strata. Mesocoic and Tertiary igneous rock also may be fairly good reservoir strata.

4. Many oil generation strata systems.

The Mesozoic and Cenozoic sedimentary basins of eastern China were superimposed on different geodesic structural components. The North China Basin was superimposed upon a middle and upper Protozeroic and Paleozoic continental surface marine basin on the Sino-Korean continental block. The basement of the Songliao Basin is the Xing'anling folded zone. The Subei and Jianghan Basins are superimposed on the Protozeroic continental seas or continental margin marine basins on the Yangzi continental block. Multiple oil generation strata systems developed not only during the Mesozoic and Cenozoic, but pre-Mesozoic strata also contain oil generation strata. In terms of their paleogeographic locations, most of these Mesozoic and Cenozoic basins were littoral continental facies lake basins. It has been proven that the Cretaceous system in the Songliao Basin and the lower Tertiary in the North China, Nanyang, Subei, Jianghan and other basins are excellent oil generation strata, and that they are the primary oil sources in these basins. Studies on the question of oil generation in recent years have felt that Carboniferous-Permian strata in the eastern basins has not been metamorphized or only slightly metamorphized, so it is possible that they have the proper conditions for oil and gas formation. There also is a possibility that the Paleozoic and middle to upper Protozeroic also contain original oil and gas pools. In summary, it is possible that oil and gas sources may have begun with the middle and upper Proterozoic and continued through the Paleozoic, Mesozoic and Cenozoic.

5. The background of complex geological structures formed and abundance of traps of varying types.

Apart from the above complex structures and faults that formed a large number of structural traps that have been destroyed by faulting, there also are several types of concealed traps. The authors have divided the concealed traps in eastern China into four categories and nine types:

Buried Hill traps

--Buried hill hilltop traps
--Buried hill hillside traps
--Buried hill hill body traps

Stratigraphic traps

--Strata superimpositon traps (above unconformity surfaces)
--Strata unconformity traps (below unconformity surfaces)

Lithological traps

--Lens-shaped lithological traps
--Sandstone upper edge thinout traps
--Colluvial fan, slope wash conglomerate traps

Mixed traps

--Fault-lithological traps

With the appropriate generation, accumulation and capping conditions, any of the above types of traps could form oil and gas pools.

II. The Complexity of Seismic Data

Unlike marine strata, there is great variation in continental surface strata media. The added complexity of the petroleum geology conditions described above makes seismic data unusually complex.

First of all, the signal-to-noise ratio for seismic data is much lower than in marine conditions. Moreover, even with data having fairly high signal-to-noise ratios, several anomalies in the geological structures often appear, making interpretation difficult. The major variations in lithology, narrow lithofacies, many structures, dense faults, unconformities and other geological factors provide few continuous reflection cophase axes in seismic profiles, anomalous waves (including lateral waves) develop, and there is serious interference. This makes it easy to confuse structural phenomena on seismic profies with stratigraphic reflections. Intrastratal structures are sometimes lost, buried hills and sandstone strata are sometimes mistakenly identified, as are flat spots and hot points, and so on. An example is the Xing 3 well region in the Daxing uplift. Because the seismic profile showed a group of strong reflection waves, it was mistakenly felt that they were T_g waves from a fault terrace. The results of exploratory drilling showed that it was a reflection from submarine fans and conglomerate interbedded with mudstone. In 1976, the seismic profile of the Zhaolanzhuang structure in the Jinxian depression [Hebei Province] showed a group of strong waves that were interpreted as a reflection from the bedrock of a buried hill hilltop. After exploratory drilling, it was discovered that it was a group of near-source dome-shaped bodies made up of breccia. Later seismic stratigraphy research and exploratory drilling information confirmed that it was a complex dome-shaped seismic facies that belonged to the class of colluvial cones formed through gravitational slippage on a slope. Structural maps of the Shulu depression [Hebei Province] were drawn according to standards prior to 1981, and there basically were no structures found in the depression. The Jingqu intrastratal structure was discovered in 1982 after careful processing and reinterpretation of the data. Moreover, well locations were evaluated on the basis of "flat spots" and other amplitude anomalies. The result was that oil was found over a large area and it was confirmed that it was a petroliferous zone. The exploration and development of the Jingqu Oilfield is one of the more successful examples of continental exploration.

There are even fewer exploration methods for ascertaining concealed traps. With the exception of local areas with excellent geological conditions at present (like Dongying), we have not seen easy-to-explain wave impedance profiles or rather precise, high-quality interval velocity sections. There also is very inadequate analysis of amplitude information, and research in this area should be strenghthened.

In summary, seismic exploration in the complex eastern part of China comes far from meeting the needs of geological work.

III. Opinions on Intensifying Seismic Exploration Work

Worldwide petroleum exploration has a history of only 100-plus years. Because the petroleum industry has developed at a fast pace, however, the amount of experience and information accumulated during exploration work is growing each day. New concepts and technologies developed over the past 20 years have been especially important in providing us with many beneficial insights. We should make use of these new concepts and technologies when dealing with the complex geological conditions of the sedimentary basins of eastern China in order to use totally new attitudes in our work. Based on their several years of work experience, the authors offer the following opinions as a reference for comrades engaged in seismic exploration.

1. First of all, we must use new ways of thinking to evaluate favorable petroliferous trap zones.

An example is the complex petroleum geology conditions in the petroliferous basins of eastern China that formed a geological background of many different types of concealed traps. Exploring the laws of their distribution is a prerequisite for finding and evaluating these traps. Practice has shown that the oil- and gas-bearing structures in these petroliferous basins usually follow structural distributions. Each of the ancient buried hill oil and gas pools in the North China Basin follow the distribution of buried hill zones. We feel most recently through our research that the other concealed oil and gas pools will be arranged in a distribution of rows and belts. We include the oil and gas bearing zones in structural zones and buried hill belts under the term trap zones, which may be divided into five major types of oil and gas bearing trap zones:

--Structural trap zones
--Buried hill trap zones
--Unconformity trap zones
--Stratigraphic superimposition trap zones
--Lithologic thinout trap zones

These trap zones have regularities in their planar distributions. It is well known that structural zones and buried hill zones often assume a linear or belt-shaped distribution. Other types of trap zones are controlled by other types of geologic backgrounds and may have linear, arc, wavy or discontinuous distributions. Unconformity trap zones, for instance, often occur on the following types of geological backgrounds: One is a flexure zone in the capping strata at the basement of gentle slopes in depressions that follows the hinge line. The second is the terrace of large faults on the flanks of a depression. They also may occur on the flanks of convex rises. For this reason, the unconformity zones often have a belt or curved shape. Lithologic thinout zones are more complex, however, because of the major variations in their shape caused by being controlled by sand bodies under paleogeographic conditions. After their sedimentation background is understood, however, there still are laws that can be followed.

Once we understand these laws, we can predict the distribution of the various types of trap zones in the basins and even search out the types of secondary structures and delineate the locations of the various trap zones. In this way, there will be laws that can be followed in the petroliferous basins, and there also will be certain concealed trap zones. Using this way of thinking in the search for oil will greatly open up our field of view and expand the scope of oil exploration.

The above viewpoints on the five types of petroliferous trap zones do not in any way contradict the currently popular theory of multiple oil and gas accumulation zones. We feel that the theory of multiple oil and gas accumulation zones interlocks with the various types of oil and gas trap zones and may be overlaid upon it. For this reason, we must clearly understand the distributional regularities of oil and gas accumulation zones, meaning that we should start with gaining a clear understanding of the various types of oil and gas trap zones, do intensive analysis of them and do our work in direct accordance with the special characteristics of each of them.

2. Make favorable trap zones the target of seismic data collection.

Although a great deal of seismic work has been done in east China, levels of precision are low in the search for the various types of trap zones and they have not been dealt with directly to a sufficient degree. Generally speaking, data from covering less than 12 times cannot meet requirements (as the degree of exploration is intensified, geological requirements are raised and the level of precision in field data collection also must continually be improved). Using this as a standard, as much as one-fourth to one-third the work in the central Hebei region must be thrown out, and the value of work that must be eliminated reaches 40 to 50 percent in some cases. This undoubtedly is equivalent to lowering the degree of exploration. Moreover, the original survey networks were deployed according to the elongated direction and distributional scope of the structural trap zones. They obviously are not suited to the search for other types of traps. For this reason, we should select targets in favorable trap zones and, after eliminating any survey lines that do not meet requirements, make great efforts to lay out new survey lines on the basis of the original ones.

Future field work must raise standard requirements to achieve high levels of fidelity, resolution and signal to noise ratios. We must make great efforts to use digital seismographs, strive to maintain a sufficient number of coverage times (usually no less than 24 times), and adopt appropriate work methods according to local conditions. Three-dimensional seismic methods also should be used in certain favorable but complex areas.

3. Deal directly with the characteristics of each type of trap for precision data processing.

Data processing is an important link in seismic exploration. Seismic techniques have developed very rapidly in this area in recent years. Although there has been an obvious improvement in the nation's processing capabilities at the present time and in the level of the data that has been processed,

we still cannot meet the geological needs of searching for traps in the relatively mature [more fully explored] regions of the east. We must make rapid and effective improvements.

This is especially true in the area of conventional processing. There is a great potential for conventional processing of seismic data and for reprocessing old data. We often can see obvious results after making a little effort to select parameters or in dealing with effective processing projects to deal with problems in a specific area. There are many examples of this. Repeated, precise and intensive processing is another important measure for improving results. Moreover, we should emphasize that amplitude processing should be continued for seismic data from east China in order to permit the interpretation of lithological changes, detection of oil and gas strata and searching for other complex traps.

Special processing is another important topic. A simple and effective project at the present time is complex number path analysis (three instants) and hydrocarbon surveys (including hot spot techniques). There should be large numbers of this sort of processing projects in each trap zone. It must be pointed out that the results of strata velocity profiles and wave impedance profiles are still not ideal (with the exception of areas such as Dongying). Although the use of seismic data for studying small strata lithology is still in the exploratory stage in other countries, they do actually provide fairly high quality strata velocity profile and wage impedance profiled. The results of America's GSI Company in using g-Log profiles of the Guxinzhuang buried hill in central Hebei were quite obvious. Based on the g-Long profile, the authors feel that this buried hill, in a splot wash-colluvail conglometactc body trap. Apart from deserving deep thought, we must do more on-the-spot work in this area in the future. Whether the use of model inversion techniques primarily for investigation and explanation of complex geological structures is rational or not is essential for interpretation work. We feel that they can be used at the stage of general surveys, surveys, sampling or precision surveys as long as an interesting geological phenomenon has been encountered. Modelling experiments should be carried out for reef blocks, igneous rock or even complex and hard to interpret local structures, buried hills, etc. After the interpretation has been determined to be rational, it can be passed upward as a geological achievement.

4. The first link in precision seismic interpretation work in favorable trap zones in the relatively mature regions of eastern China still is solid structural mapping.

Although seismic information can solve a lot of geological problems at the present time, the basic route is still structural standardization and the provision of high quality structural maps. The authors feel that a set of high quality structural maps (not a single map) should reflect objective reality, clearly illustrate the concepts used in preparing the map and distinctly reflect structural shapes to the most realistic degree. The standards are:

1) The regional contours of the structure should be clear and local contour maps should be attached as necessary.

2) The locations of the high points of local traps and trap occurrences should be clear.

3) The strata to be shown in maps should be determined by requirements. Two reflection layer structural maps showing the locations of structures or other traps between a map's standard strata can be added. Attention also should be paid to structural maps of interesting shallow or deep strata.

4) Different shapes should be used to illustrate the structural shape, occurrence, closure conditions and so on for each type of trap.

5) When there are many different programs, there should be different types of program maps.

6) Structures and other straight lines should be illustrated with dotted and solid lines.

7) Planar and profile maps should be coordinated.

We offer the above preliminary understanding only as a reference.

5. Another important topic of interpretation in eastern China is dealing directly with drafting methods in the search for trap categories.

There should be research on all types of traps on the basis of existing structural maps to make adjoining maps that reflect their enclosure conditions. An examples is the combination of sectional and top surface maps of a buried hill for fault block-type buried hill traps (the line of joining should be above the top line of the top edge of the fault for a fault block hill) in order to illustrate the closure conditions and occurrence of the buried hill. The strata above and below an unconformity can be shown to make joint maps of unconformity traps. Structural maps of the top and bottom plates of the strata that have been superimposed (the target strata) should be drawn for superimposed thinout traps, with each map showing the location of the thinout superimposition lines. These maps can be laid one on top of the other.

The enclosure factors (area, amplitude, etc.) of the trap being sought can be calculated on the basis of the special structures of the trap conditions.

6. Study and make good use of seismic data interpretation and drafting systems.

Foreign countries began using various types of small computer-controlled interpretation and drafting systems a few years ago. Examples include the Discovery System of America's Digcon Company, the Vax 11/780 used by America's GSI Company, and so on. We should import and utilize these things and manufacture them on a trial basis here in China. These interpretation

computers are a beneficial tool for interpretation personnel. Their terminals can be used for comparing, analyzing and drafting maps. This saves a lot of tedious work by interpretation personnel and gives them more energy to put into thinking and working. It must be pointed out that, although these computers have many functions, they still are only tools and can be operated only by the thought of interpretation personnel. If we can integrate the complex geological structures in China and carry out direct research on software to expand their functions, then this will be even better.

7. Rapidly extend three-dimensional seismology techniques.

Excellent results using three-dimensional seismic technologies have already been obtained throughout the world, and there is no doubt that this is the direction for seismic exploration in the complex regions of China. There have been many reports on this in foreign countries. Obvious results in 3D seismology have been obtained in central Hebei's Guxinzhuang, Henan's Wennan, Jianghan's Gaochang and other areas. In terms of their cost, the total expenditures for 3D seismology in Guxinzhuang and Gaochang were the same as the costs of drilling only a single well. For this reason, we should make great efforts to develop 3D seismology work in the favorable complex belts in eastern China.

Moreover, we should apply the patterns of thought used in three-dimensional seismology to develop two-dimensional seismology. Some seismic experts in China feel that the basic difference and superiority of three-dimensional techniques compared to two-dimensional ones is 3D homing. Our seismic exploration work itself involves bulk 3D measurements. Simple data networks on two-dimensional seismology are even scarcer. We can use extrapolation from two-dimensional seismology regions with fairly close lines (1 km X 1 km or 0.5 km x 0.5 km) to encrypt data networks and then use this information to carry out 3D offset experiments. Or, we can provid 3D slices to carry out 3D interpretation. The authors feel that this way of thinking is a very good one and should be tried.

8. Accelerate the testing and utilization of vertical seismic profiling.

Vertical seismic profiling (VSP) was first studied and applied in the Soviet Union. It also has developed rapidly in Western countries in recent years. Excellent results using this method have already been obtained in Western countries and in the Soviet Union. Chief Engineer Meng Ersheng [1322 1422 4141] recently has been repeatedly doing propaganda, organizing and promoting work in this area, which is very farsighted. Vertical seismic profiling first of all can accurately compare well sites and seismic positions. This will solve the problem of accurate comparisons of seismic waves and seismic locations that has existed in seismic geology interpretation work for years, and will provide a firm and reliable foundation for research on lithologic measurements and complex structures. Of course, it also can be very beneficial in other capacities such as providing the needed deconvolution, wavelet processing and calculated absorption coefficients in a particular region, for studying horizontal waves, or even for investigating complex geological structures near well sites.

9. Do good basic theoretical research on seismic geological interpretation.

The increasing abundance of seismic information over the past few years has permitted more and broader geological questions to be answered. Seismic exploration has developed from simply providing structural maps to being concerened with almost all problems in the realm of oil and gas exploration. The new interdisciplinary program of "Petroleum Seismic Geology" is now being applied and developed in the field of petroleum geology. In order to do good seismic exploration work in eastern China, we geological personnel must earnestly study and apply seismic information, and we should do research on several basic problem and research methods in seismic geology. Examples include using seismic information for research in the areas of stratigraphy and lithology, for studying the characteristics and evolutionary regularities of petroliferous basins, for research on syngenetic and epigenetic structures, for research in the areas of oil generation and evolution, and for research on predictions using data from all exploration periods. This will expand the presence of seismic information in petroleum exploration and give full play to its role.

Conclusion

There are abundant oil and gas resources in eastern China and bright prospects of oil and gas. The complex geological structures in the region make exploration extremely difficult, however. Good seismic work is essential for rapidly increasing reserves. The above opinions on improving seismic exploration in eastern China are based on the authors' experiences over several years of work, and are offered to our readers as references.

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12539
CSO: 4013/33

OIL AND GAS

PETROLEUM GEOLOGICAL WORK IN THE NORTHWEST REVIEWED

Beijing ZHONGGUO DIZHI [CHINA GEOLOGY] in Chinese No 11, 13 Nov 84 pp 21-24

[Article by Gao Qinghua [7559 1987 5478] of the Ministry of Geology and Mineral Resources No. 562 Comprehensive Team]

[Text] This article will use the concepts of geological mechanics to provide some preliminary opinions on petroleum geology work in the Northwest for the reference of others.

I. An examination of the Distributional Laws of Petroleum Resources in the Northwest in Terms of Geological Structural Characteristics

In geological terms, the Northwest Region refers to the vast area north of the east-west structural belt running from Qinling to Kunlun and west of Jialanshan. The distribution of petroleum resources in the region is determined by the geological structural characteristics of the Chinese continent.

1. Basins that often are sites of rich petroleum reservoirs were formed in the areas of compound structural depressions in structural systems. The depressions or basins in the structural systems that were formed after the Mesozoic or through renewed activity are favorable areas for petroleum exploration. They are controlled primarily by latitudinal, northwest-oriented, Hexi system or arced epsilon-shaped structures. The primary pre-Mesozoic structural systems were: latitudinal structural belts like Tianshan--Mingshan and Kunlun--Tailing; the Kangdian--Jialanshan longitudinal structural belt, the Monggol arc-shaped structural belt, and so on. These structural systems controlled the distribution of ancient oil-bearing lithic systems.

2. A process of seawater intrusion and regression determined the locations of oil generation beds. Three major marine transgressions and several small-scale marine transgressions occurred on the Chinese continent. The marine transgressions came primarily from a southern direction (from the west in some areas) and moved northward. The first major marine transgression occurred during the Cambrian era, the seawater reaching the Tianshan-Kunshan latitudinal belt.

Marine regression begain during the middle Ordovician and the seawater had moved off the Chinese continent by the Silurian era. The second northward advance of seawater began during the Devonian era, and there are mid-Carboniferous land-sea interface facies strata north of Tailing. The seawater retreated south of Tailing during the late Carboniferous and Permian eras. During this period, the north had basically changed to land-sea interface or continental facies sediments by the late Carboniferous and Permian, while the south remained marine facies sediments. The south also had become land-sea interface facies sediments by the late Permian. At the end of the Permian, seawater from the Arctic Ocean transgressed southward and the area north of Yinshan became marine facies sediments. At the beginning of the Triassic, seawater from the third marine transgression did not go past Tailing and the sea regressed in the late Triassic. The scope of marine transgression became increasingly smaller after this time, and Jurassic-Cretaceous marine facies strata basically are found only in coastal areas to the south and southeast of Bayankeleshan. After the period of Yanshan movement, the seawater withdrew further southward and Tertiary marine facies sediments are seen only in a belt at the southwest and southern margins of the Chinese continent and Taiwan.

The prospects for petroleum on marine facies in China should first of all be oriented southward. Apart from the marine facies strata in the middle Cambrian system, mid-Ordovician system and Carboniferous-Permian system in some parts of northwest China, the major part is continental oil-generating lithic systems. The general laws of their distribution are that, as marine transgression occurred in the south, the northern continental climate was warm, humid and favorable for oil generation. The primary locations are the middle Jurassic and lower Cretaceous below the late Triassic and the lower parts of the Eogene and Neogene systems.

In the period of geological history, belts of intense activity like trenches and other structures and the position of the land-sea boundary migrated with regularity along the direction determined by the driving forces, as did the oil generating lithic systems. The geological structure of the Chinese continent assumed an arc shape extending to the south.

According to international statistical laws, oil and gas reservoirs have a tendency to increase as the age of the parent rock and reservoir strata decreases, and many large oilfields often are concentrated on the outer edge of arc-shaped belts. For this reason, Xizang, western Yunnan, coastal regions and the continental shelf area are the focus of petroleum geology work.

There are other arc-shaped structures that have influenced the evolution of the geological structures on the Chinese continent. A structural belt centered

on the Irkutsk belt in the Soviet Union also began assuming an arc shape extending southward in the Caledonian period that extended to the Yinhan-Tianshan latitudinal belt. The northeast plains, the Jungar Basin and the Nei Monggol plateau are its outer boundaries.

These regularities in the evolution of the basins after the Mesozoic caused the primary oil source lithic systems to gradually become newer moving south, southeast and southwest from the Shaanxi-Gansu-Ningxia Basin, and the sedimentation centers of the basins also migrated accordingly.

II. Opinions on Developing Petroleum Geology Work in the Northwest

1. Study the processes of marine transgression and regression and paleoclimatic changes to clarify the temporal distribution of oil generating strata.

As mentioned previously, there was a marine transgression from the west during the late Paleozoic, so this is a favorable area in the search for marine facies petroleum. The middle and upper Cambrian, Ordovician, Carboniferous and Permian systems in the Kalpin area in southern Xinjiang were capable of producing oil. To the east of this region, the lower part of the Carboniferous system is mainly sediments of coal-bearing clastic rock. The seawater transgressed eastward and northward during the middle Carboniferous. The Tarim Basin, the eastern and western Junggar regions and the Qilianshan mountainous belt commonly contain mainly carbonate sediments and are capable of producing oil. After the marine regression during the late Carboniferous, the entire continental region became continental facies sediments. Marine facies oil-producing strata may be found only on the southwestern rim of the region. During or slightly after the period of marine transgression, mixed and dark color sandstone and mudstone accumulations became common in the northwestern part of the continental facies. They are excellent oil generation strata, and their main periods are the late Tertiary era, the early to middle Jurassic, the early Cretaceous and the Oligocene and Miocene eras.

2. Study the characteristics of regional structures and infer prospective oil areas.

Accumulations in oil generating strata must have a broad basin, but the distribution of the basins is controlled by structural systems. The oil producing basins is controlled by structural systems. The oil producing basins in western China are mainly controlled by a combination of latitudinal structures, northwest-oriented structures, the Hexi system and other structural systems (see Figure 1).

1) Northwest-oriented structures (western system): these were formed by a series of uplifted and subsided zones, the most obvious uplift being the Qilianshan-Ziluokenushan structural belt. Its sides are upper Paleozoic and Mesozoic

sedimentary depression belts. They formed into basins because of being separated by latitudinal structures, northwest-oriented structures and the Hexi system, and are favorable areas for oil exploration.

a) The northern side of the Qi-Zi (Qilianshan-Ziluokenushan] uplift zone is the western edge of the Jungar Basin, the western end of the Turpan Basin, the western end of the Jiuquan Basin, eastern Wuwei and other regions.

b) The southern side of the Qi-Zi uplift zone is the Kuche depression of the Yining Basin, the area between A'ergan and Kuche to the west of Luobubo, the Qaidam Basin, the Nuoergai depression and other areas.

There is a parallel uplift north of the Qi-Zi uplift belt running from Qimatageshan down into the Tarim Basin, as well as the associated Awati Depression and Kumukuli Basin.

2) Latitudinal structural belts: these are one type of system that controlled the distribution of petroliferous basins in the northwest. Examples include the Yinshan--Tianshan belt and the northern side of the Tailing--Kunlun belt and uplift belt, which often are favorable areas for the formation of oil producing strata. They include:

a) The Wusu, Urumqi and other areas on the northern side of the Yinshan--Tianshan belt.

b) The Yecheng--Hetian area to the north of the Tailing-Kunlun belt, the southern rim of the Qaidamu Basin and other areas.

Attention should be paid to whether or nor there are concealed oil pools on the northern sides of latitudinal depression belts.

3) Northeast-oriented structural belts:

The largest northeast-oriented structural belt is located at the western edges of the Junggar and Tarim Basins and is the eastern flank of a Euro-Asian epsilon-shaped system. Another northeast-oriented structure is the A'erjinshan structural belt which also passes through Turpan, west Luobubo and other areas. There are additional northeast-oriented structural belts. These northeast-oriented structures have two special characteristics: 1) They have a left-pushing torsion quality and there also frequently are low-order torsional structures on either side that control petroleum accumulation. 2) The basins on the eastern side often have sedimentation centers that migrated from west to east and that are deeper in the west and shallower in the east. There is a regular gradual rise in the location of the oil producing strata moving from west to east. For this reason, even if the petroliferous basins in northwestern China are controlled mainly by latitudinal and northwest-oriented structures,

there also are three obvious primary irregular rows of oil pools along a northeast direction: the northwestern rim of the Junggar Basin, at the northwestern rim of the Tarim Basin (which may extend to the northwest of Urumqi), and the A'erjin belt.

4. Arc-shaped structural belts:

The arc-shaped structural belts of the northwest include the Monggol marginal arc and the Alashan arc which affect northern Ningxia and Gansu, and eastern Junggar. The western flank of the Qilujia epsilon-shaped system and the reflex arc on the western flank affected the area where Gansu and Qinghai meet. The eastern flank of the epsilon-shaped Euro-Asian system and the reflex arc of the eastern flank affected the northern part of the Junggar Basin. The arc linking the eastern flank of the Euro-Asian epsilon-shaped system with Tianshan affected the northwestern edge of the Tarim Basin. The Hetian arc affected the southern margin of the Tarim Basin. According to these regularities, the outer edge of the southward-protruding arcs and the inner edge of the northward-protruding arcs often are locations of oil accumulation. The strata in the area of the protruding arc of the former type become increasingly newer, while the strata locations get higher as one moves toward the inner edge of the latter. Based on these regularities, we should explore in the northern part of the Qaidam Basin, the northern part of the Junggar Basin, the northwestern part of the Tarim Basin, the No. 1 Santanhu Belt, the western part of the Badanjilin Desert and the area east of Wuwei.

5. In the Hexi system, oil generating depressions often formed where the northwest-oriented structures joined those with an east-west orientation, and they even play a certain role in oil accumulation. The industrial oil fields in many of the oil generating depressions in Western China often are concentrated on the western or southern edges of the basins. Examples include the Yishan Basin, the Sichuan Basin, the Jiuquan Basin, the Qaidam Basin, the Tarim Basin, and others. Even though the reasons are not clear at present, they should be given attention in oil exploration work in the northwest.

In addition, tension fractures and subsidences with fairly thick oil generating accumulations may have formed parallel to the direction of the compression forces.

3. Study the characteristics of strata buildup, understand the material conditions for oil generation.

The marine facies strata that are capable of generating oil in the northwest are carbonatite strata, but the most important oil generating strata still are continental facies oil generating strata. The best are formed of mixed color and mixed land facies fragment buildup, which is one type of buildup that

occurred in deepwater lake facies and deep depression basins. In this environment, the vast areas of water were conducive to the growth of large amounts of floating organisms. Rapid sedimentation under conditions of a stable and sustained rate of subsidence that was faster than the rate of sedimentation may have created reduction conditions that protected organic matter and generated petroleum. In the belts of depressions in the structural systems, especially in the locations where several structural system depression belts meet, the rate of subsidence was even higher and was favorable for oil generation.

It must be pointed out that the gradual drying of the water bodies caused their salinity to increase gradually. The areas of deepest subsidence in the end often became salt basins that contain rich accumulations of potassium, sodium, boron and other salt minerals. For this reason, the salinity of the upper strata may be used as an indicator of the existence of an oil generating depression. The saline water regions of eastern China coincide with several large oil fields. For this reason, the areas of western China that contain salt water should receive attention in petroleum exploration work.

4. Study the special characteristics of paleogeothermal fields, determine the environmental conditions of oil generation.

In geothermal fields in China, the ground temperature is fairly high in the anticlinal parts and in compression and torsion fracture zones. The ground temperature is fairly high in compression structure belts in structural systems. The temperature also is fairly high in areas where structural systems meet. These are illustrated in Figure 2.

Recognizing this regularity is of great real significance in the search for oil. This is because areas with the appropriate temperatures for oil generation may be delineated according to the regularities in crustal stress fields and geothermal fields. The stratigraphic ground temperatures of the Mesozoic and Cenozoic were low in northwest China. The ground temperatures were relatively high only near uplift structural belts and compression fractures. These areas were conducive to oil formation and are buried at fairly shallow depths. Paleozoic strata usually were fairly thoroughly metamorphized in structural belts of intense compression and exceeded the oil generation temperature threshold. Attention should be paid to structurally mild areas. We should, however, pay special attention to gas formed from coal in Paleozoic strata.

Petroleum formation is a chemical process that continues after the petroleum is formed, and it gives off a bit of heat. Oil and gas pools show up as anomalies in the local temperatures in the regional geothermal field. The rise in temperature above oil and gas reservoirs may extend all the way to the surface. The geothermal imcrements are high in the top portions of reservoir structures in the Daqing, Fuyu, Shengli and Qaidam Basins. The temperature anomalies

caused by oil pools often may destroy the usual regularities in the geothermal field. We should, therefore, study the special characteristics of the modern geothermal field, which may become a method used in petroleum prospecting.

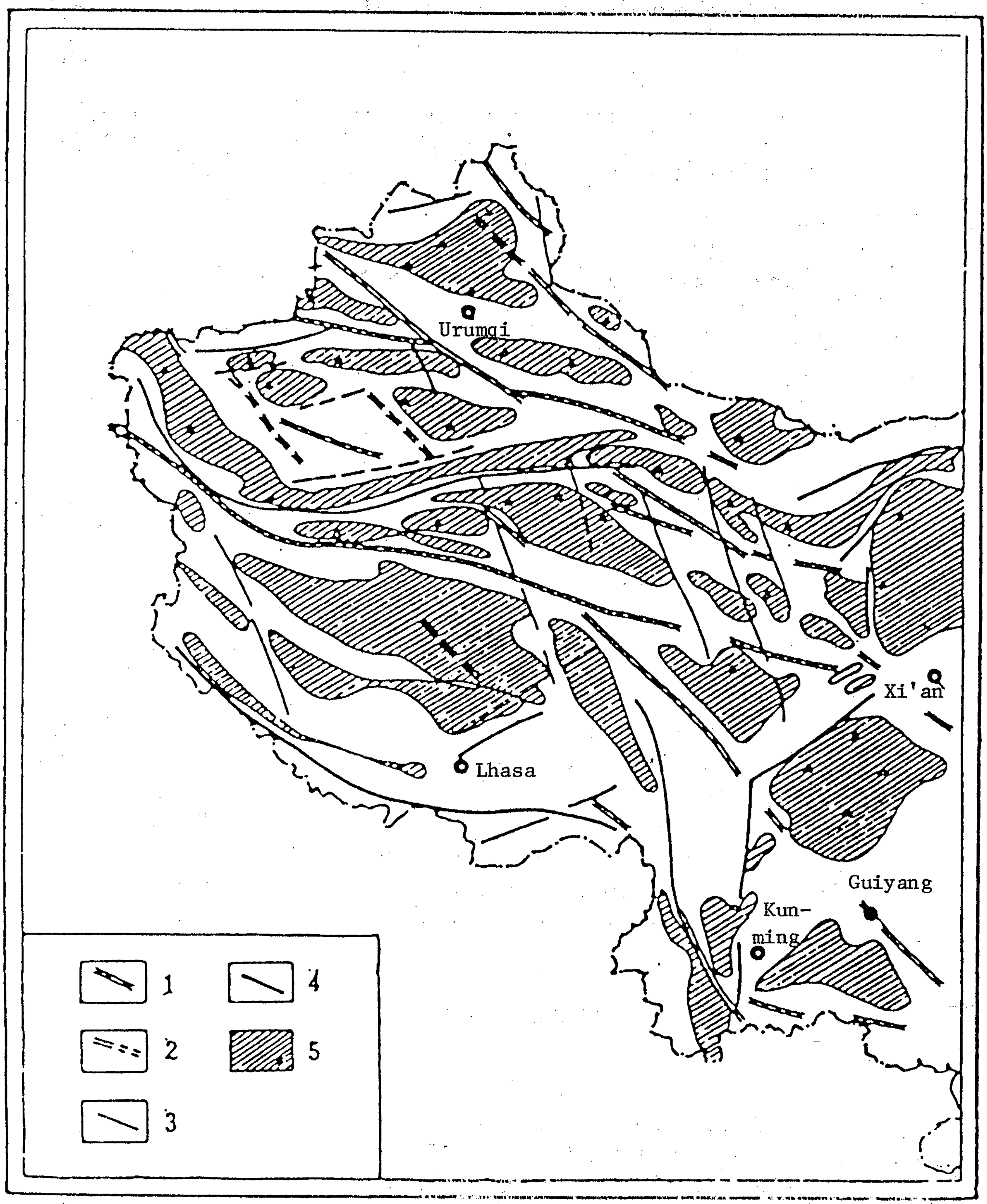
5. Petroleum that has already accumulated may migrate because of changes in crustal stress fields. For this reason, one of the key points in studying the accumulation and dispersion of petroleum in the future is to do research on the special characteristics of and changes in the crustal stress field.

In the process of rock formation, the oil droplets may be compressed toward the margins or contemporaneous fissures and, because of underground water, especially pressurized water, the oil droplets may be forced out of the rock strata and migrate above the underground water. Although this is certainly not the only factor, crustal stress is the primary driving force in oil droplet migration, especially torsion. After studying the shape of reservoir structures in the Qaidam Basin, Professor Li Siguang [2621 0934 0342] visualized them as a twisted towel in areas with the proper conditions for oil generation. The reservoir structures controlled by rotated structures are important oil pools.

An examination of current information on northwestern China shows that most oil fields that are controlled by rotated structures lie in circular or semicircular vortices (depressions) in anticlinal rotated zones. The rotational compression could have caused the petroleum to accumulate first of all in the anticlines and form industrial oil fields. If this sort of rotation continued to intensify and penetrated the depression, and even formed an uplifted structure in the center of the depression, then their significance in oil accumulation would be greatest during the period before the rock strata had completely solidified. The crustal stress would have been conducted primarily through the basement. Basement uplifts in oil generating depressions should, therefore, receive greater attention. Moreover, one side of a rotational fracture should receive more attention because of the possibility that the torsion may have caused the petroleum to be concentrated into oilfields.

In summary, we should study the material components of oil generating strata during petroleum exploration. We also should do research on the distributional regularities of oil generating strata. This requires us to study the shapes of reservoir structures as well as their formational regularities, development and destruction. We must study the threshold temperature and burial depth of oil generating strata as well as the characteristics of and changes in ground temperature. We should do comprehensive research in the area of oil formation such as the special characteristics of oil generating strata, ground temperature and structures, and we should use the perspective of unified activity to study regularities in the mutual relationships between them. Only in this way will we be able to grasp the regularities in petroleum endowment and point out the direction for petroleum prospecting.

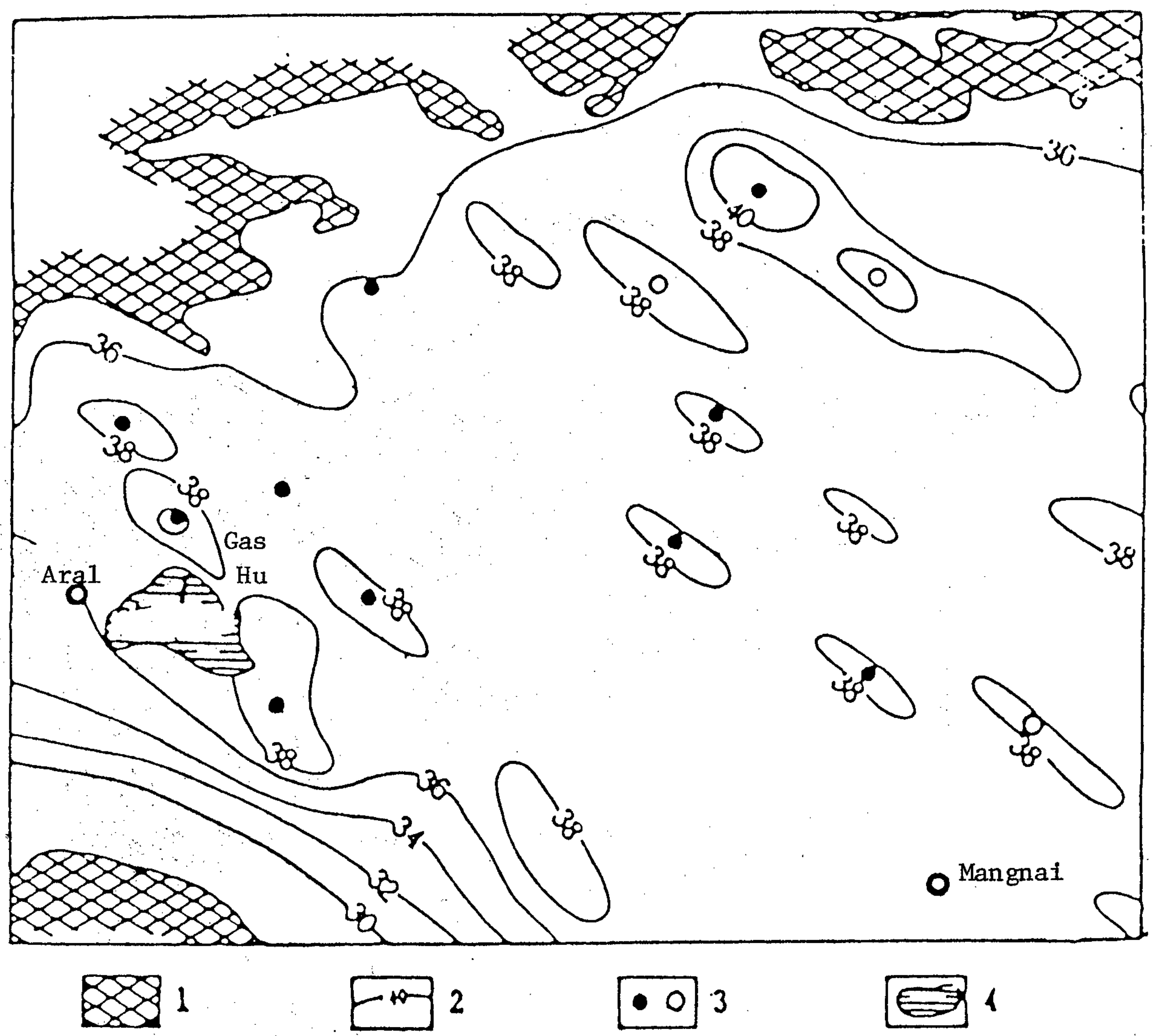
Figure 1. Diagram of the Distribution of Prospective Oil Regions in Western China



Key:

1. Latitudinal uplift structural belt
2. Northwest-oriented uplift structural belts (dotted lines indicate concealed structural belts)
3. Hexi system uplift structural belts
4. Uplift structural belts of other structural systems
5. Uplift structural belts of other structural systems

Figure 2. The Relationship Between Ground Temperature and Petroleum Distribution in the Western Part of the Qaidam Basin



According to Zhang Yechang [1728 2814 2052]

Key:

1. Mountains
2. Ground temperature isotherms (° C)
3. Oil fields and possible oil fields
4. Lakes

12539
CSO: 4013/51

OIL AND GAS

ON THE POTENTIAL FOR OIL AND GAS IN THE KUCHE DEPRESSION

Beijing SHIYOU KANTAN YU KAIFA [PETROLEUM EXPOLORATION AND DEVELOPMENT] in Chinese Vol 11, No 4, 1984 pp 1-6

[Article by Zhang Lianbi [1728 6647 3880] and Jiang Mingxin [1203 2494 2450] of the Xinjiang Petroleum Administration: "The Laws of Jurassic Oil and Gas Accumulation in the Kuche Depression"]

[Summary] The Kuche Depression is a primary structural component in the northernmost part of the Qaidam Basin in Xingjiang. The depression covers an area of more than 30,000 km^2, extending 680 km from east to west and varying in width from 30 to 75 km from north to south. The depression has eight secondary structural zones: five uplift and four subsidence zones. The depression also contains 59 local uplift structures, 15 of them primary local structures. Oil and gas occurences have been found at more than 80 sites.

The Cenozoic is sands'one and mudstone sediments from a dry climate and oxidized environment and reaches its maximum thickness of over 6,000 meters at its southern end. The Mesozoic could be as thick as 4,000 meters or more. Each system is formed of a large set of normal cycle sedimentary rock bodies. Oil formation conditions were excellent in the Middle Jurassic and Upper Permian systems, and there are excellent reservoir and capping layers. The Mesozoic in the depression is piedmont depression sediments. There is a sedimentary discontinuity and angular disconformity between the Cenozoic and Mesozoic, forming two sedimentary strata structures.

Drilling was begun in eight anticlines in 1954, but no oil was found for more than 20 years except the discovery of the locally-generated, locally-stored Yijikelike oil pool and the Jurassic industrial oil flow at the top of the Tuke'erming anticline. No other oil or gas pools have been discovered since. The failure is attributed to inadequate understanding and improper drilling locations.

Source strata and oil sources: The Middle Jurassic is the primary source strata system, as shown by the Yijikelike oil pool. Oil and gas accumulation in the Yijikelike oil pool was controlled mainly by anticlines, with oil accumulation at the top of sand bodies. Vertical profiles show interchanging gas, oil and water strata and the quality of the crude oil varies. The crude is blackfish green in the upper strata, with a specific gravity of 0.81; it is yellow in

the lower strata, with a specific gravity of 0.77 to 0.80. The organic carbon content in 205 samples of Jurassic and Permian source mudstone ranged from 0.16 to 2.88 percent, and averaged 0.79 percent. The trichloromethane asphalt content ranged from 150 to 2,930 ppm in 202 samples, and averaged 1,000 parts per million. The oil is at a mature stage, as shown by a relfectivity of the lens-like bodies generally above 1 and a sporo-pollen color index of 3 to 4. Some 39.7 percent of the thickness of the Jurassic and Permian systems is gray-green and dark littoral facies mudstone and shale, a source area of more than 10,000 km^2.

Analysis of crude oil from several wells in the depression by the Lanzhou Petroleum Geology Research Institute showed that Jurassic crude contained only Jurassic sporo-pollen and no external components while the Cretaceous crude contained both Cretaceous and Jurassic sporo-pollen. The Neogene crude contained Tertiary, Cretaceous and Jurassic sporo-pollen, indicating that the oil source was the Jurassic system.

The crude oil from the various strata had a carbon value ranging from C_9-C_{31}, with a peak near C_{14}. The carbon isotope $\delta^{13}C$ ranged from -20.5 to -22.8 percent. The OEP value ranged from 0.75 to 1.05, and the ASI structural distribution coefficient shows that the oil in the different strata came from the same source.

Formation of the depression: The continual regression of the Paleozoic Tianshan Trench in combination with the concurrent relative subsidence of the adjoining southern base formed a Mesozoic piedmont depression. The interface between the trench and the depression formed the several hundred kilometer long high-angle Beibugulu fault. The first sedimentary cycle occurred during the Permian, and the second involved the Jurassic system on top of the Permian. Uplifting in the eastern part of the depression then caused the Jurassic sediments to be thinned or denuded. The top of the Jurassic was denuded to varying extents in the other parts of the depression. Yijikelike and the area to the east continued to be slowly uplifted during Cretaceous sedimentation. The Mesozoic sediments were later folded by tectonic activity. The eastern part of the depression was uplifted considerably, forming the embryonic Tuke'erming and Yijikelike anticlines. Repeated faulting also occurred during this period. The second period of activity of the Himalayas during the Pleistocene folded the Cenozoic strata and re-metamorphized the Mesozoic. The Tuke'erming and Yijikelike anticlines were uplifted again. Xishan activity formed the Chiulitake fault and also caused renewed activity in earlier faults. The second period of Xishan activity formed four reverse faults in the central part of the basin that control the local structures. The Mesozoic structures below formed shelter faults, not antilcines, so there is an obvious difference between the upper and lower groups. The southernmost fourth row of anticlines are shallow and medium depth Cenozoic folded strata, not reverse faults.

All of the oil and gas found at the surface and through drilling was in Jurassic sediments. A small amount of the gas and oil produced in the Middle Jurassic system migrated to the Cenozoic or to the surface along the

fracture zone of the faults. There was no oil or gas occurrence at some of the faults. During the later part of the Mesozoic, the Jurassic source stratum was buried at a depth of more than 1,300 meters and at a ground temperature over 65 C. The Mesozoic paleostructure formed during the second period of Yanshan activity was most favorable for the first accumulation of oil and gas. The embryonic anticlines of Yijikelike, Tuke'erming and Yinanqianfu were formed during this period, and were favorable for oil and gas accumulation. The north-leaning reverse faults formed during the second period of Yanshan activity fractured the Mesozoic and Cenozic all the way to the surface. This destroyed the first oil and gas accumulation in the Mesozoic near the faults and led to reaccumulation at the higher locations sheltered by the faults, forming a locally generated and stored oil and gas pool. In the Bashenjiqike, Tuziluoke and Jidianke faults, for example, an oil source to the south could have been shielded by the lower wall of the faults. Both sides of the Kumeikelimu fault are source areas and oil and gas may have accumulated in the upper and lower walls. The source of the Kasangtuokai and Dongquilitake faults lay to the north, and the upper walls may have trapped oil and gas. Only small amounts of oil and gas may have migrated upward along the fracture zones in compression reverse faults. Moreover, all of the upper Jurassic is cherry-red mudstone 150 to 400 meters thick, forming an excellent capping stratum for the entire depression, so it would have been difficult for a secondary accumulation of oil and gas above the Jurassic.

Areas favorable for drilling:

1. Kumeikelimu and Kasangtuokai Regions

These are two surface anticlines extending 40 km from east to west that were formed by the torsion of the upper wall of the north-leaning faults. Oil-bearing sandstone has been found at many locations along the Kumeikelimu fault, with the oil sands reaching a maximum thickness of 47 meters. Several oil sands and natural gas shoots have been found along the Kasangtuokai fault. Drilling began here in 1954, but no Jurassic target strata were found because of improper well location. Future drilling in this area will focus on the upper and lower walls of the Kumeikelimu fault, where it is predicted that the target stratum will be hit at 3,500 meters. When the top of the mid-Jurassic fault block is found, drilling will continue southward until the mid-Jurassic is located.

2. Jidianke and Dongqiulitake Regions

It is quite possible that the oil produced in the center of the Jurassic source between the Bashenjiqike and Dongqiulitake faults may have migrated north or south and been sheltered by the faults. The Jidianke uplift is an area favorable to oil and gas accumulation. A well at Dongqiulitake encountered the lower wall at 1,425 meters. There were oil and gas occurences in the upper wall but none in the lower wall, indicating that the oil migrated from the north. Future drilling will involve the higher parts of the northern and southern structures in the region. Exploratory drilling for an oil and

gas pool sheltered by the upper wall of the Dongquilitake fault should be carried out 2.5 km to the north of the axis of the surface anticline, where the target stratum may be hit after 4,000 meters. The most favorable area is the northern part. The Jidianke anticline is favorable and the target strata may be found at less than 3,000 meters.

3. Tuziluoke and Yinan Terrace Regions

The Yijikelike and Tuke'erming anticlines in the north are ancient Yanshan period antilcines that continued to develop during the Xishan period. They are extremely favorable for oil and gas accumulation, and were the sites of the first gas and oil occurrences discovered. The Mesozoic and Cenozoic systems to the south of these two anticlines are a large monocline inclined to the south and extending 70 km from east to west and 20 km from north to south and contain only Middle Jurassic oil source regions. The oil and gas they produced migrated northward to the higher parts where it may have accumulated in the buried uplifts on the monocline and in the region sheltered by faults on the anticlines. Seismic testing revealed a buried uplift 22 km to the south of Yijikelike. The Tuziluoke reverse fault 10 km south of Tuke'erming is also a favorable location for oil and gas accumulation and for exploratory drilling.

12539
CSO: 4013/6

OIL AND GAS

PROSPECTS FOR PETROLEUM IN YILIPING DEPRESSION, QAIDAM

Beijing SHIYOU KANTAN YU KAIFA [PETROLEUM EXPLORATION AND DEVELOPMENT] in Chinese Vol 11, No 4, 1984 pp 31-38

[Article by Yang Zhilin [2793 3112 2651] of the Qinghai Petroleum Administration Gelogical Research Institute: "A Discussion of the Sedimentary Environment in Qaidam Basin's Yiliping Depression"]

[Summary] The Yiliping Depression covers an area of 15,000 km^2 northwest of the center of the Qaidam Basin. There is sedimentary rock 15,000 meters thick at the center of the depression. Six exploratory wells found unconformities, three structures and different degrees of oil and gas occurrences. One well produced more than 50 liters of oil flow and oil drops at about 5,500 meters during washing. Examination of the geological conditions at Yiliping indicates that the conditions are not favorable for oil and gas generation.

The upper segment of the Tertiary Xiazi group in the Qaidam Basin is an important oil source strata system. The strata are thinner and the rock finer in the area extending from Gasikule to Shizigou and Yanshuiquan in the southern part of the Basin's western portion, which received fairly deep lake facies sediments as a sedimentation center during the Tertiary, and is the Tertiary oil source region. At Jiandinghsan, Youquanzi and other areas in the northern part of the Basin's western portion, however, the strata are thicker and the rock quality is coarser. This area was a center of subsidence and did not have an oil generation capacity.

The Yiliping Depression was a center of subsidence, not a sedimentation center. There as a intense subsidence in the depression from the Tertiary on, accompanies by replenishment by material coming from nearby water systems in the ancient mountains. This formed thick strata of coarse rock. The rapid replenishment basically prevented any changes in the Basin's ancient topography of a downward slope from east to west. The Yiliping area was primarily shallow lake shore facies in the Tertiary Xiayou segment (Pliocene). There is a full cycle of coarse-fine-coarse sediments at the rim of the depression and a normal cycle of coarse-fine sediments in the center of the depression. The sediments below the Xiayou and Shashan groups are assumed to be even coarser.

Analysis of some indicators for a single well near the center of the depression indicated that the Youshashan group (Pliocene) was shallow lake facies sediments containing very little organic material. Organic carbon changes ranged from 0.05 to 0.38 and averaged 0.2 percent.

Trichloromethane asphalt ranged from 0.0041 to 0.0373 percent and averaged 0.01 percent. The organic material was mainly humus with a very low hydrocarbon output rate. The rock is not a type that generates oil and the lower limit of the oil generation window is at 5,020 meters.

In general, the relative qualities of the finest rock strata in the Yiliping Depression show that it is shallow lake facies sediments that are not oil-generating. The area north of the depression's center is also not ideal for oil generation and no industrial flows have come from four wells already drilled there. The deeper Gancaigou group is even coarser and less suited for oil generation, and exceeds the lower limit of the oil generation window.

12539
CSO: 4013/6

OIL AND GAS

THICKENED OIL RESERVES VERIFIED IN XINJIANG

OW010346 Beijing XINHUA in English 0228 GMT 1 Feb 85

[Text] Urumqi, 1 Feb (XINHUA)--China has verified 648 million tons of thickened oil reserves in its northwest Xinjiang Uygur Autonomous Region.

The estimated reserves of thickened oil in the region are more than 1.3 billion tons, according to local petroleum industry administration.

The verified reserves are mainly distributed in a fault belt 250 kilometers long and about 25 kilometers long and about 25 kilometers wide between Karamay and Urho, northwest of the Junggar Basin. The Karamay oilfield has succeeded in exploiting heavy oil by using high-pressure steam injection technology. The oil has a low content of sulphur and wax, a strong temperatural sensitivity, and is deposited in shallow geological formations and easy to extract.

CSO: 4010/91

OIL AND GAS

DRILLING OF TRIAL PRODUCTION WELL IN BEIBU GULF BEGINS

OW030805 Beijing XINHUA in English 0653 GMT 3 Feb 85

[Text] Guangzhou, 3 February (XINHUA)--Drilling of the first trial production well of the Wei 10-3 oil field in the Beibu Gulf of the South China Sea started on 30 January, according to the Nanhai West Petroleum Corporation.

This is a joint project between the China National Offshore Oil Corporation (CNOOC) and the French Total-Chine Corporation under a contract signed in Beijing in May 1980.

So far, four exploratory wells have been sunk in the structure and tests showed that two of them produced a daily average of more than 1,000 tons of crude oil.

Six production wells are planned in the first stage of the project.

The oilfield in the Sino-French cooperation zone is expected to begin production next year. The highest yearly output should be between 600,000 and 700,000 tons (about 4.2 million to 4.9 million barrels).

CSO: 4010/90

OIL AND GAS

BIDDING OPENS ON EQUIPMENT FOR KARAMAY

OW151951 Beijing XINHUA in English 1503 GMT 15 Feb 85

[Text] Beijing, 15 February (XINHUA)--The first bids for the supply of machinery and equipment for Karamay oil field in the Xinjiang Autonomous Region were opened in public today.

Forty-one bids were received. Representatives of 18 manufacturing firms from the United States, Japan, Canada, France, Romania and Hong Kong attended the bid opening ceremony, which was under the auspices of the International Tendering Company of the China National Technical Import Corporation.

The project is financed by a World Bank loan equivalent to 100 million U.S. dollars. The bids are mainly for the purchase of drilling machinery, well-repairing equipment, logging instruments and universal machinery.

Evaluation of the bids will start soon and contracts are expected to be awarded in May, according to an official of the tendering company.

The Karamay oil field produced 4.5 million tons of oil in 1984, ranking fourth in the nation.

CSO: 4010/90

OIL AND GAS

BRIEFS

NEW HENAN PIPELINES--Zhengzhou, 16 Feb (XINHUA)--Two oil and gas pipelines have been put into operation in Henan Province, today. The oil pipeline is 284-kilometers long from the Zhongyuan oilfield to Luoyang City, a heavy industrial center in China. It has an annual transmission capacity of two million tons of crude oil. The 148-kilometer long gas pipeline will supply a fertilizer plant in Kaifeng with 110 million cubic meters of natural gas each year. The Zhongyuan oilfield is in the eastern part of Henan near Shangdong. [Text] [Beijing XINHUA in English 1631 GMT 16 Feb 85 OW]

LUOYANG CRUDE REFINERY--Zhengzhou, 10 Dec (XINHUA)--A refinery for crude oil from the Zhongyuan oil field now being developed has gone into operation. The refinery at Luoyang can presently handle 1 million tons of crude oil and its annual capacity will eventually rise to 5 million tons, official sources here said. Zhongyuan oil field, a major energy project during China's Sixth Five-Year Plan period (1981-85), is a 5,300-square-kilometer area encompassing 12 counties in northern and eastern Henan Province and southwestern Shandong Province. It is expected to produce in 1985 an annual average of 5 million tons of crude oil and anywhere between 500 million and 700 million cubic meters of natural gas. A 284-kilometer-long pipeline to the Luoyang refinery is near completion. [Text] [Beijing XINHUA in English 1451 GMT 10 Dec 85 OW]

CSO: 4010/84

NUCLEAR POWER

QINSHAN PROJECT ENTERS SECOND PHASE OF CONSTRUCTION

Work Begins on Main Power Plant Buildings

Beijing RENMIN RIBAO in Chinese 25 Jan 85 p 1

[Text] Qinshan, 24 January--Zhao Hong, vice minister of the Ministry of Nuclear Industry, announced today that work has now begun on the main buildings of the Qinshan Nuclear Power Plant, the first such plant to be Chinese-designed and built.

The site of Qinshan Nuclear Power Plant is located between the sea and the foot of Qinshan Mountain in Haiyan County, Zhejiang Province. After a year's work, construction personnel have built a seawall some 1,780 meters long and 7 meters high and have excavated 1,080,000 cubic meters of earth and rock to prepare for the construction of the main plant buildings. The main construction includes the nuclear reactor pile safety containment structure, auxiliary safety structures, the nuclear fuel building, the turbine building, and the control room.

The nuclear reactor of the Qinshan power plant is a pressurized-water reactor with an installed capacity of 300MW. The reactor was designed by the Shanghai Nuclear Engineering Research and Design Institute (formerly the 728 Research and Design Institute) of the Ministry of Nuclear Industry, the Huadong Electric Power Design Institute, and other units. The design incorporates the best of both domestic and foreign technology and safety-wise it matches advanced international standards of the late 1970's and early 1980's.

Personnel Urged to Finish Early

Hangzhou ZHEJIANG RIBAO in Chinese 25 Jan 85 p 1

[Excerpt] With the official beginning of work on the foundations of the main building for the reactor pile, the Qinshan Nuclear Power Plant construction project entered its "second campaign". Vice Minister of the Ministry of Nuclear Industry and project director Zhao Hong, at a mobilization meeting held on the 24th, urged construction personnel to continue their hard work, to unite and cooperate, and to build carefully in order to complete this campaign ahead of schedule.

The Qinshan Nuclear Power Plant was designated a major state construction project following its review and approval by Premier Zhou Enlai before his death. After work officially got under way in June 1983, the "first campaign" construction tasks were completed 50 days ahead of schedule, paving the way for this campaign's construction of the main and auxiliary buildings. The major tasks of the "second campaign" are pouring the concrete for the foundations for the main reactor pile building. Although the time is short, the scale of construction large, and the technology complex, it is imperative that this work be completed by the end of June 1985. In order to conduct this campaign successfully, the engineering design personnel must furnish blueprints ahead of schedule, material supply organs must do everything possible to organize the needed materials at various locations, and the contract responsibility system must be implemented at all levels of the construction units.

CSO: 4013/101

SUPPLEMENTAL SOURCES

QINGHAI DEVELOPS SOLAR, WIND ENERGY RESOURCES

OW220735 Beijing XINHUA in English 0646 GMT 22 Feb 85

[Text] Xining, 22 February--Qinghai Province has built more than 10,000 soalr energy stoves and 600 wind power generating units in its farming and pastoral areas.

Farmers and herdsmen in the province used to use animal droppings as cooking fuel and butter oil for lighting. About 36 percent of the peasant households had not enough fuel for cooking.

In recent years, the provincial government paid great attention to developing solar, wind energy and other new energy sources. It has established research institutes and development corporations to speed up their utilization.

This has resulted in a fast development of solar energy stoves, wind power generating units, solar heaters, solar cells and other equipment.

In Suhe village of Hualong Hui Autonomous County, the first model village set up to demonstrate the use of solar and other energy sources, every household has a solar stove or energy-saving stove and a biogas pit.

CSO: 4010/91

CONSERVATION

COMMISSION ANNOUNCES SUCCESS IN ENERGY CONSERVATION EFFORTS

OW270858 Beijing XINHUA in English 0841 GMT 27 Feb 85

[Text] Beijing, 27 Feb (XINHUA)--Chinese enterprises saved energy equivalent to 30 million tons of standard coal in 1984, the most since 1981, according to the State Economic Commission.

This largely explains last year's 13.6 percent increase in industrial output value when energy production rose only 7.4 percent.

It resulted from new technology and equipment and improved management, an official said.

Energy consumption per ton of steel was cut by 20 kilograms and per ton of synthetic ammonia by 300,000 kilocalories nationwide last year.

Sealed transport technology saved oilfields 100 million cubic meters of natural gas for heating oil.

Low-energy manufacturing was expanded greatly and high-energy manufacturing restricted, saving energy equivalent to 14 million tons of standard coal.

CSO: 4010/98

CONSERVATION

STATE ECONOMIC COMMISSION URGES ENERGY-SAVING MEASURES

OW131131 Beijing XINHUA Domestic Service in Chinese 1451 GMT 12 Feb 85

[By reporter Zhu Zemin]

[Text] Tianjin, 12 Feb (XINHUA)--At the national economic work conference, the State Economic Commission called on all localities, departments, and enterprises to take the opportunity provided by reform to step up efforts in energy conservation and do a good job in the following five fields this year:

Firmly grasp the reform in energy conservation and effectively solve the problem of "everyone eating from the same big pot" in the distribution and use of energy. It is necessary to adopt effective economic and administrative means to try out the policy of holding each unit responsible for the amount of energy allotted to it and giving priority to outstanding units in the supply of energy. It is necessary to resolutely implement the policy of imposing additional charges or fines for energy consumed beyond fixed quotas and to limit or stop the supply of energy, or even issue orders to stop production for the purpose of consolidation, to enterprises seriously wasting energy. Revenues from the additional charges and fines should be used for assisting enterprises to carry out energy-saving technical transformation and launching conservation activities. It is necessary to institute a contract responsibility system for energy conservation of various forms in enterprises and, by combining the responsiblity, power, and interests of staffs and worker, use economic means to encourage conservation.

Improve the system for supervising energy conservation by carrying out reform. A number of localities and departments have formulated or are formulating trial regulations for energy conservation. It is necessary to combine these efforts, from top to bottom, to jointly do this work well.

Offer good guidance and service and adopt policies to help promote energy-saving technical transformation in enterprises. All localities and departments must step up overall guidance by providing technical and information services, assisting enterprises to speed up the formulation of energy-saving plans for each trade, defining the direction and policy for energy-saving technical transformation, and guiding enterprises to formulate annual conservation plans. Aside from the fixed amount of loans arranged under state unified plans, it is also necessary to tap financial resources and raise

funds from various quarters for energy conservation. All localities may adopt measures suitable to local conditions, such as offering loans and inducing foreign funds, in tapping financial resources for conservation.

Raise to a new level the quality of energy conservation management in enterprises. All localities and departments should organize enterprises to do a good job in such basic work as balancing energy resources, managing the set quotas, and keeping accurate energy statistics in order to enable enterprises to intensify energy conservation supervision step by step and gradually formulate a complete set of energy-saving measures with economic means as its principal component.

Step up energy conservation training and improve the work of energy-saving technical service centers. The State Economic Commission will continue to set up local energy conservation training centers. All localities, departments, and major energy-consuming enterprises should launch energy-saving training in various forms in order to raise the quality of the contingent of energy-saving personnel.

CSO: 4013/91

CONSERVATION

OIL REFINERIES REDUCE ENERGY CONSUMPTION

OW260804 Beijing XINHUA in English 0748 GMT 26 Jan 85

[Text] Beijing, 26 Jan (XINHUA)--Technical and managerial improvements have helped Chinese refineries save the equivalent of more than 8 million tons of oil since 1979, today's ECONOMIC DAILY reports.

The measures enabled the country's 30 largest refineries to process 5.7 percent more crude while cutting per-unit energy consumption by 32.5 percent, saving the equivalent of 8.17 million tons of oil. The energy conservation programs also brought production gains, and have earned back five times their original investment, the paper says.

China's major oil refineries use domestically-produced equipment. Low technical standards and poor management resulted in high consumption of energy.

The plants have since been extensively upgraded under projects begun in 1979. Over the past 5 years, the state and the refineries themselves have spent more than 600 million yuan on 104 energy conservation and management programs. As a result, the amount of energy needed to process a ton of crude oil was reduced to 720,000 kilocalories from 1.05 million kilocalories, an average annual rate of over 7 percent. Oil production also increased by 6.7 million tons a year inthe same period.

The refineries are now aiming at bringing their energy consumption down to 700,000 kilocalories per ton of oil refined.

CSO: 4010/88

END